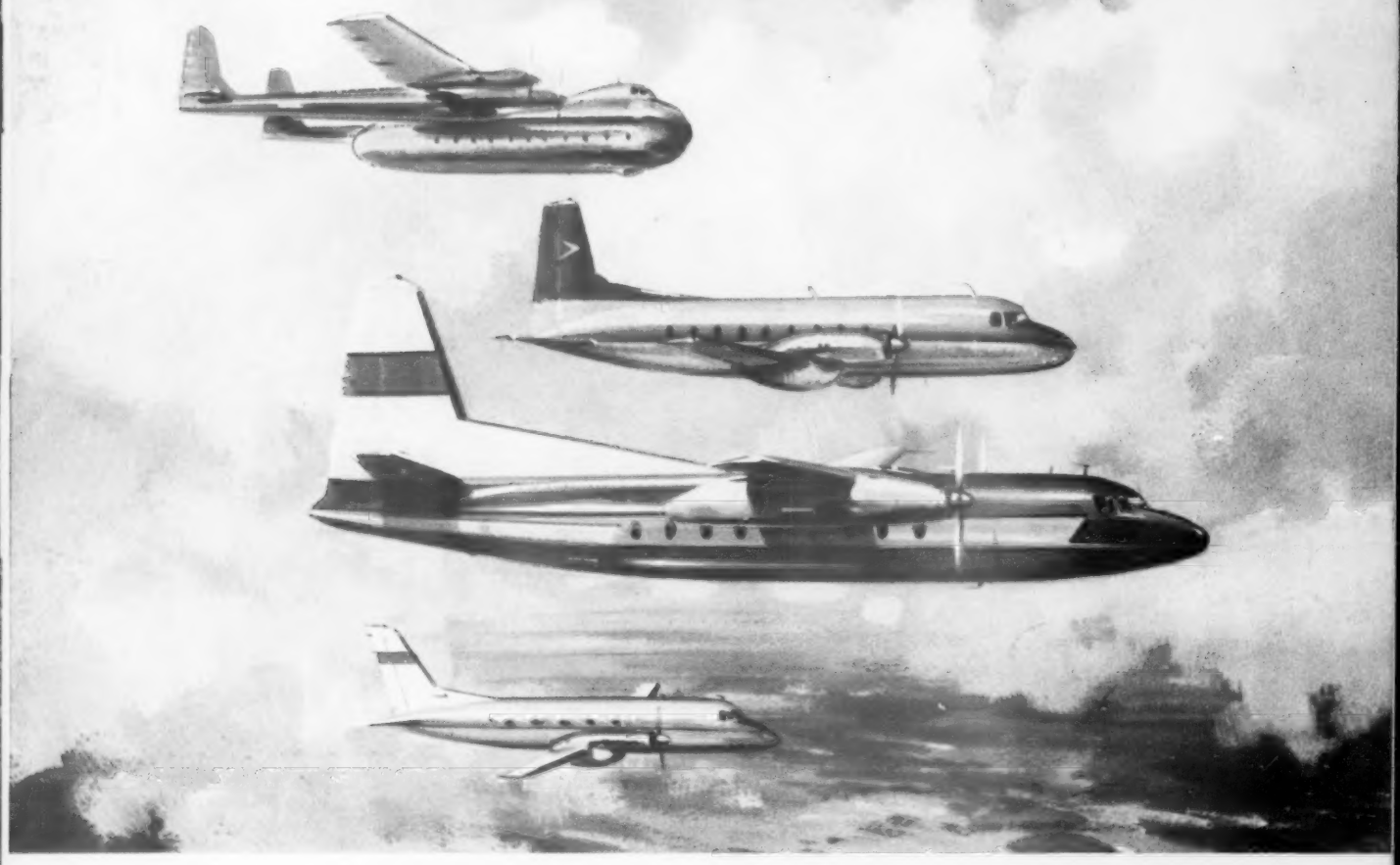
THE AEROPLANE and ASTRONAUTICS

AUGUST 17, 1961

EVERY THURSDAY
ONE SHILLING
AND SIXPENCE



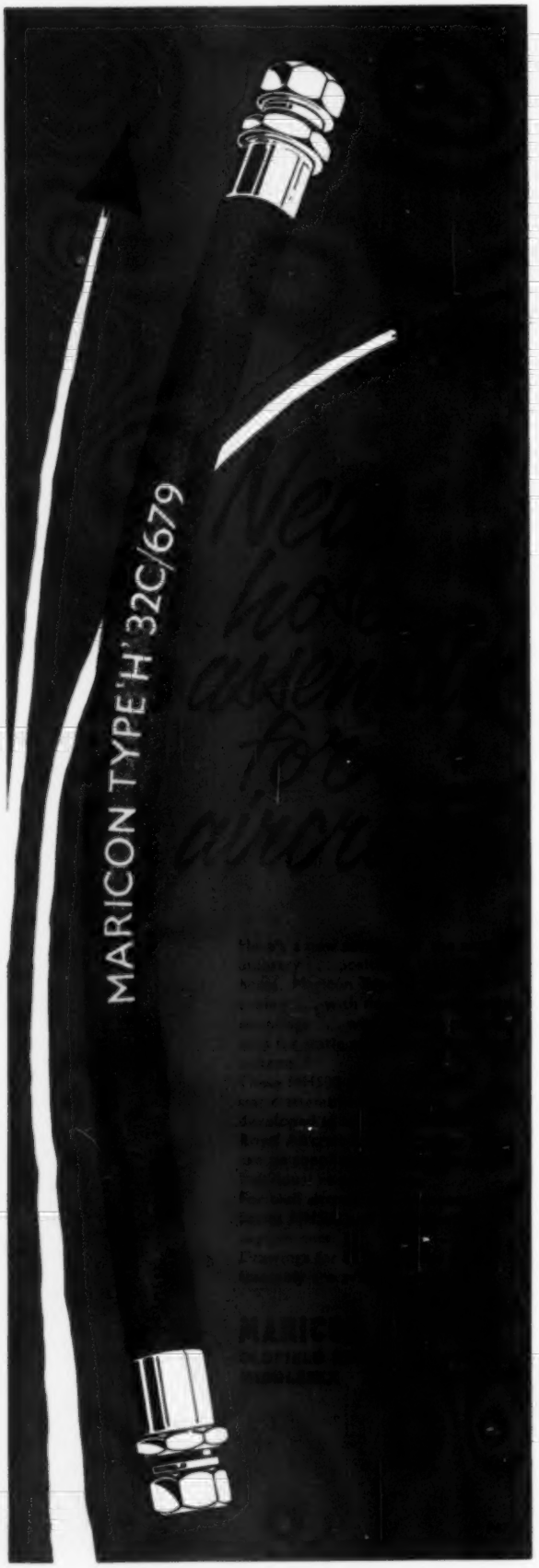
ROTAX

BUILDS WITH EXPERIENCE

. . . standardisation. A basic A.C. D.C. generating system is installed in the ARGOSY, AVRO 748, FRIENDSHIP and GULFSTREAM ensuring similar servicing on a world-wide basis. The latest system in this range is the SOLID ROTOR ALTERNATOR.

ROTAX

ENGLAND · AUSTRALIA · CANADA.



Ekco transistorised airborne Weather Radar systems are designed for all types of modern aircraft

STANDARD The standard Type E190 radar, as supplied or scheduled for many of the world's latest airliners, consists of a scanner, transmitter/receiver and indicator and weighs under 60 lb.

LIGHTWEIGHT By using a new, lighter scanner, we have reduced the weight to 46 lb. which makes the equipment suitable for installation in smaller executive and private aircraft.

DUPLICATE The Ekco Duplicate System has a total weight of only 103 lb.—less than half that of other single systems. It provides full 'fail-safe' conditions, either transmitter receiver unit operating with either indicator unit.

To simplify servicing, the basic electronic units are common to all systems.

See the Ekco Weather Radar Systems on our Stand 193/194 at Farnborough, together with Automatic VHF/DF Equipment and Transistor Inverters.

EKCO

ahead in electronics for aviation

EKCO ELECTRONICS LTD · SOUTHEND-ON-SEA · ESSEX · TELEPHONE SOUTHEND 49491

WPS-376

Second class postage paid at New York, N.Y.

U.S. NAVY-SIKORSKY HSS-2 SPEEDS TO NEW WORLD RECORD

On May 17th at Bradley Field, Connecticut, U.S. Navy pilots in a Sikorsky HSS-2 crossed the finish marker on a three-kilometer straight line course to set a new world helicopter speed record. The speed: 310.4 kilometers an hour—41.5 kilometers an hour faster than the previous record set by a Russian Mil-6 over a 100-kilometer closed circuit in 1959. This was the first official speed test of the new generation of Sikorsky twin-turbine helicopters. The boat-hulled HSS-2, which flew in its standard configuration, soon goes into fleet service with the U.S. Navy as a key weapon in anti-submarine warfare defenses. It is the world's most advanced helicopter weapons system—and now the world's fastest helicopter as well.

United Aircraft International

East Hartford 8, Connecticut, U.S.A.

HAMILTON STANDARD · SIKORSKY · NORDEN

European Headquarters: 3/5 Warwick House Street, London S.W. 1, England

A

ONE OF THE AUTOMOTIVE PRODUCTS GROUP

AUTOMOTIVE PRODUCTS COMPANY LTD., Leamington Spa, Warwickshire

REGD. TRADE MARK 'PUROLATOR'

FOKKER—THE MAN AND THE AIRCRAFT

BY HENRI HEGENER

NOW ON SALE

ORDER YOUR COPY NOW

Over 100,000 words, 400 photographs, 48 1/72 scale 3-view tone paintings, over 200 Fokker types reviewed. Here, in one 224-page volume, is told the whole story of Fokker's youth and early experiments; his rapid rise to fame during the 1914-1918 war when he designed and produced for the German Air Service; his removal to Holland after that war and establishment of his firm in the country of his birth; the world-wide use of his aircraft in the inauguration and development of international air lines; his entry into the American aircraft industry, and the story of the Fokker firm to date.

Size is 8½" × 11¼", 224 pages cloth bound, weight is 2¼ lb., price 45/-. Write to Dept. AP/FO for illustrated leaflet describing fully contents of this book.

HARLEYFORD PUBLICATIONS LTD.

LETCHWORTH, HERTFORDSHIRE, ENGLAND

for

FARNBOROUGH

Book your chauffeur-driven car

NOW *by ringing* TERminus 2898

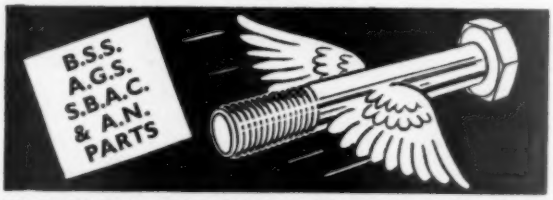
Daimler Hire

LIMITED

7, HERBRAND STREET, LONDON, W.C.1

MILLER AVIATION LTD.

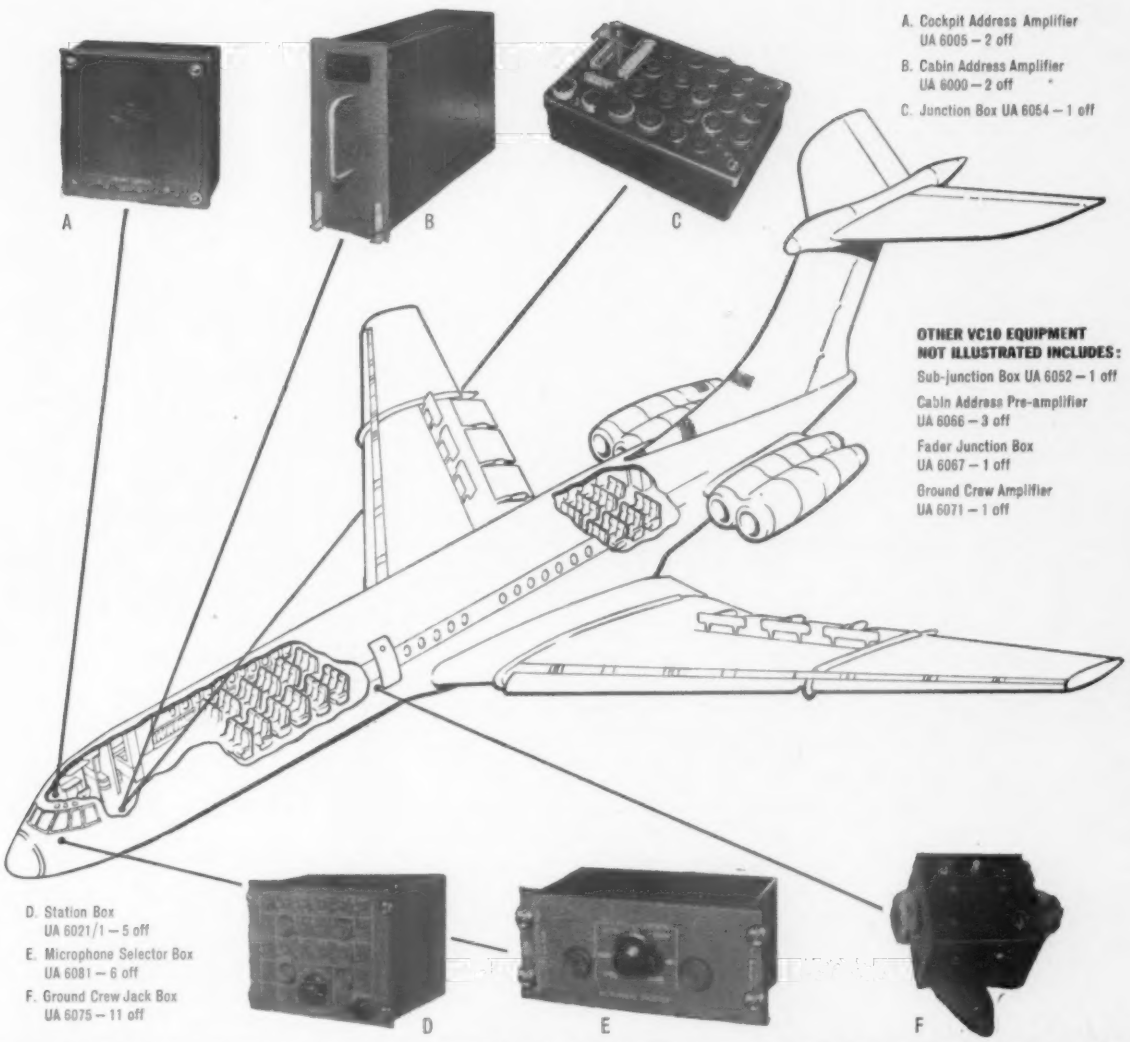
A member of the group of companies



TEL.: REDHILL 5050 *CABLES:* SASCO - REDHILL - TELEX
TELEX: 21433

ADASTRAL HOUSE

NUTFIELD · REDHILL · SURREY


A. Cockpit Address Amplifier UA 6005 – 2 off
B. Cabin Address Amplifier UA 6000 – 2 off
C. Junction Box UA 6054 – 1 off
A
B
C
OTHER VC10 EQUIPMENT NOT ILLUSTRATED INCLUDES:
Sub-junction Box UA 6052 – 1 off
Cabin Address Pre-amplifier UA 6066 – 3 off
Fader Junction Box UA 6067 – 1 off
Ground Crew Amplifier UA 6071 – 1 off
D. Station Box UA 6021/1 – 5 off
E. Microphone Selector Box UA 6081 – 6 off
F. Ground Crew Jack Box UA 6075 – 11 off
D
E
F

YOU'LL FIND ULTRA

COMMUNICATION CONTROL, INTERCOM & CABIN ADDRESS

. . . in the VICKERS VC10*

The versatility of Ultra Type UA 60 Communication control and intercom equipment is clearly indicated by the variety of aircraft for which it has been specified, ranging from the Westland Scout helicopter, with seven services, to the Short Bros. and Harland Belfast transport aircraft with thirty-one. And it is equally suitable for American and British radio installations. Audio diffusion amplifiers range from a 2-watt cockpit address type—with integral, but detachable, speaker—to a 60-watt unit developed for use in the Vickers VC10 passenger address system.

* *Announcement by courtesy of Vickers-Armstrongs (Aircraft) Limited*

ULTRA

Please send for brochure

ULTRA ELECTRONICS LIMITED

WESTERN AVENUE · LONDON · W3 · Telephone ACOrn 3434

COMMUNICATIONS · CONTROL AND INSTRUMENTATION · DATA PROCESSING EQUIPMENT

The Hawker P.1127 vertical take-off strike aircraft. Its hydraulically-powered flying controls are made by Fairey's Hydraulics Division.

Whichever way it takes off... Fairey make the power controls for it

FOR...

VTOL (P. 1127 and Rotodyne)
HELICOPTER (Belvedere)
CIVIL (D.H. Trident)
FIGHTER (Hunter and Fiat G.91)
TRANSPORT (Beverley)
PHOTO-RECCE. (Canberra PR.9)
TRAINING (Fiat G.82)
RESEARCH (F.D.2)
ANTI-SUB. (Gannet) and
STRIKE (Scimitar)

...AIRCRAFT

Fairey's Hydraulics Division has made more hydraulic power control units than any other company in the world.

Fairey Engineering Ltd HYDRAULICS DIVISION · HESTON · MIDDLESEX

A member of The Fairey Group of Companies.

THE AEROPLANE and ASTRONAUTICS

VOLUME 101 NUMBER 2600 AUGUST 17, 1961

On Not Shooting the Pilot

It used to be a practice in the West when it was ruder, if not wilder, than it is now, to display a notice exhorting the audience not to shoot the pianist as he was doing his best. There has recently been a noticeable tendency to discharge firearms far too close to the heads of pilots of airliners, not, however, because their standards of performance are inadequate by hyper-discriminating passengers but for much more lawless reasons, exactly analogous to piracy on the high seas. And, of course, it is along analogous lines that the responsible authorities will have to act.

Those of us who have grown up with civil aviation have grown up with freedom of access to the flight deck—which is only unfrightening because it has become so familiar. Yet in other forms of transport access to the man at the wheel is rather more restricted.

The nerve-centre of a locomotive is certainly out of the passengers' sight and even in a corridor train out of reach. Anyone who wished to get at the driver of an express train would have to get across the coal tender. In modern diesel-engined trains, it is true, the driver's privacy has been reduced to that ensured by a sheet of plate glass.

Access to a liner's bridge needs some determined barrage-bursting by passengers, but this has been done by pirates and will no doubt be done again. Yet the contrast remains.

In most airliners the door between the passengers' cabin and the flight deck is more often open than shut. Perhaps on longer flights this is more to give the flight crew a chance to go aft than for passengers to go forward. Nevertheless, passenger morale, in general, seems more likely to be enhanced by shutting off the flight deck than making access easy. And no doubt airlines will move towards such a decision.

But to lock the flight crew on the flight deck is not going to ensure their complete protection against determined armed men. By the nature of their construction pressurized craft of light alloy are not easy to render shot-proof. For the same reason the provision of armed guards to shoot it out with desperadoes is not calculated to make much appeal to nervous passengers either. And the IATA facilitation committee is likely to take a poor view of regulations requiring the "frisking" of passengers before embarkation.

As a first step, nevertheless, it would seem reasonable to seal off the flight deck from the cabin. This would at least make it more difficult to press a gun in the pilot's back.

Why the Mystery?

No one interested in such matters can fail to be impressed by the Russian successes in putting man into orbit and in effecting successful recovery. Likewise one is impressed with the degree of reticence shown about technical details of the achievement. It is fascinating to speculate, for instance, about the means employed to put Vostok I and Vostok II on *terra firma*. Why have the Russians given no information about the manner in which this was done?

Editor - - - - THURSTAN JAMES
Deputy Editor - - - - F. T. MEACOCK

Founder Editor (1911-1939) *C. G. Grey*

Proprietors: - - TEMPLE PRESS LIMITED
Chairman and Managing Director:
ROLAND E. DANGERFIELD

Editorial, Advertisement and Publishing Offices:
BOWLING GREEN LANE, LONDON, E.C.1.

Telephone: TERminus 3636
Telegrams: "Pressimus London Telex"
Telex: 23839

Annual Subscription Rate: United Kingdom £4 15 0
Overseas £5 Canada and U.S.A. $15.00

© Temple Press Limited, 1961. The proprietors will consider any written requests to reproduce articles and illustrations appearing in this journal. Comment and brief extracts which acknowledge *The Aeroplane and Astronautics* are permissible.

Matters of Moment

In this Issue

THE technical effort that goes into a present-day transport aeroplane and the new thinking which has been applied to one of the new British turbojet airliners are indicated on pp. 181-186. On these pages artist J. H. Clark "describes," in his own characteristic way, the details of the VC10's control systems, and associated test rig, in four pages of perspective and schematic drawings. These are accompanied by an article explaining the philosophies which lie behind the design of the systems.

On pp. 188-189 will be found most of the technical and other information which has so far become available about the 25-hour, 17-orbit "flight" by Major Titov in Vostok II which was initially reported on p. 143 in last week's issue.

The flight assessment (No. 103 in the series) of the Cessna 185 Skywagon on pp. 178-180 is especially informative in that its author, John Fricker, flew the 185 in the International Business and Touring Aircraft Competition and its performance and characteristics are described in relation to this competition.

The final selection of three sites from which London's heliport may be chosen are shown in air-to-ground photographs, with the approximate areas likely to be needed, on p. 175.

Wren has been away on holiday but he has left us a drawing (p. 191) which helps, as always, to put aviation into a new kind of perspective.

New Atlas Launched

FIRST of the Atlas F series ICBMs was launched from Cape Canaveral on Aug. 9. Aimed at an impact point near Ascension Island, the first R. and D. model reached a speed of about 15,000 m.p.h. and travelled more than 5,000 miles.

Atlas F, which will be capable of carrying a heavy nuclear warhead at least 6,300 miles, employs storable propellents thereby greatly enhancing the missile's reaction time. It will be housed in underground "silos." The three engines—central sustainer plus two lateral boosters—have a combined thrust of approximately 389,000 lb. compared with about 360,000 lb. for earlier models.

Piracy at High Level

THERE were two more cases last week in which armed passengers took over, or attempted to take over, airliners flying on normal scheduled services. A Pan American DC-8 which had taken off from Mexico City on its way to Panama City was forced to "divert" to Havana on Aug. 9 and there was a gun battle on board a Cuban airliner which was force-landed by the wounded co-pilot. In the previous week, on Aug. 3, a 707 was put down at El Paso, Texas, after being taken over by gunmen.

Only in the case of the Cuban airliner was there any loss of life. This fact must be attributed to the skill and good sense of the flight crews concerned. In most displeasing circumstances the two turbojets were put down at airports which were at least mildly unsuitable for such aircraft, and the crews obviously kept their heads and appreciated the probably disastrous consequences of serious resistance.

The prospects of gun play, or even of unarmed tussles, on the flight deck of a turbojet transport do not bear thinking about. Neither the locking of flight-deck doors nor the carrying of arms by crews can be considered seriously as a means of dealing with possible airborne outbreaks of violence.

Incidentally, most of the reports of these unfortunate events have described the pirates as "hi-jackers." This word was coined in the U.S.A. during the 1920s to describe the members of one criminal group which appropriated the illicit property (usually bootleg liquor) of another equally criminal group. The word is hardly applicable to the recent events.

Whitworth Gloster Aircraft

TWO of the companies within the original Hawker Siddeley Group—and among the oldest units in the aircraft industry—are to be combined. They are Sir W. G. Armstrong Whitworth Aircraft (formed in 1921) and the Gloster Aircraft Company (formed in 1915). The combined company will be known as Whitworth Gloster Aircraft, Ltd.

The two companies have, in fact, been working in fairly close co-operation for some years. Both factories worked on the Gloster Meteor and Javelin. At present both are building components for the Avro Vulcan bomber and the Avro 748 turboprop transport, and Gloster Aircraft has been doing work for Armstrong Whitworth on the A.W.650 Argosy freighter. The two factories are about 60 miles apart.

The chairman of the new company will be Mr. Hugh Burroughes, who is chairman of Gloster Aircraft, and the managing director will be Mr. W. S. D. Lockwood, the managing director of Armstrong Whitworth.

Boeing and the SST

PERTINENT comments on supersonic transport prospects appeared in an article in the July issue of the *Boeing Magazine* by the company's president, Mr. William M. Allen.

"Work," Mr. Allen writes, "could begin tomorrow on a supersonic transport for purposes of international prestige; but if our objective is to enter a United States supersonic aeroplane in the world airline market, it must be competitive; it must be superior. Before we can make such an entry, we have ahead a formidable list of research projects.

"Thus, the question is not whether such an aeroplane will be constructed, but when, by whom and under whose auspices. The cost, whoever shares in it, will be high. Our present estimates place the dollar outlay required to design, construct and flight-test a prototype supersonic transport at approximately $100 million, exclusive of engines.

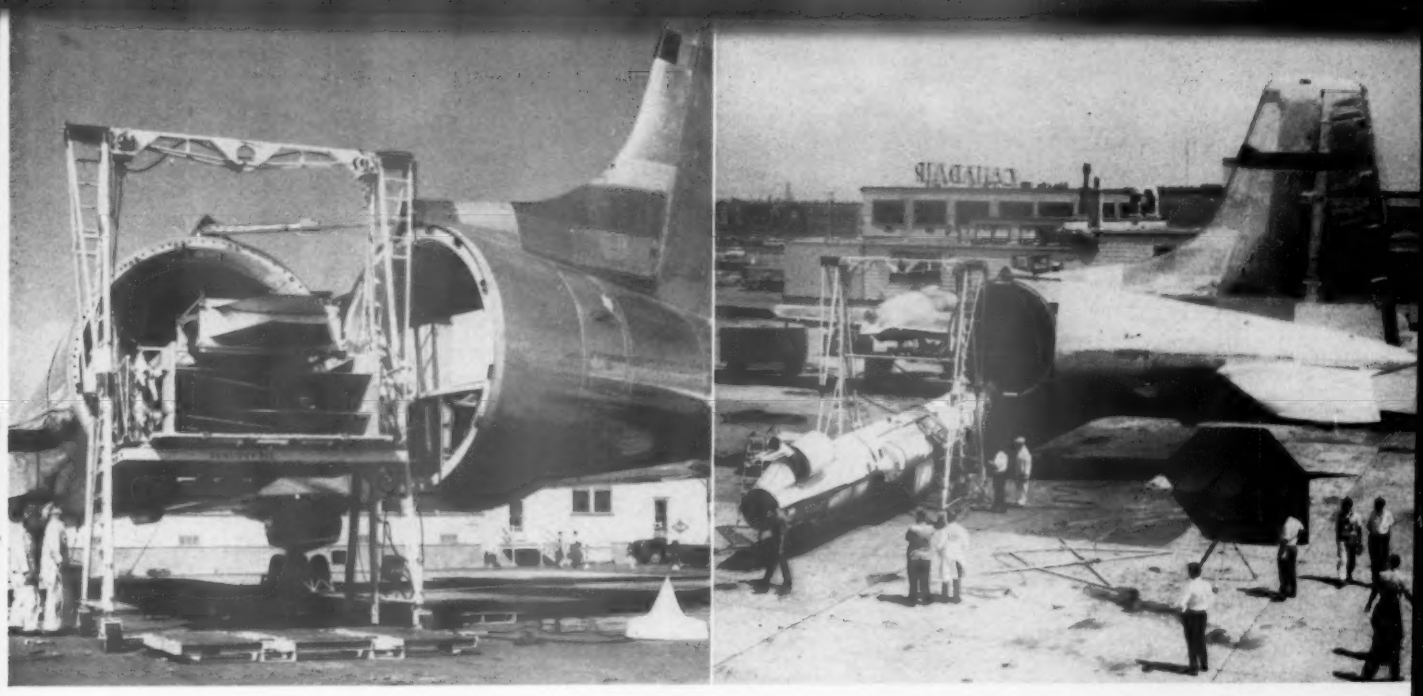
"The time required to do the job may well be a function of the research effort made before prototype construction begins; if we assume that the major research problems would be well toward solution in two years, the airlines could have supersonic transports in operation by the end of this decade.

"If the time factor is too greatly compressed, there will be insufficient room for discovering errors and making adjustments in production. If we wait too long, we could see our national position in this field deteriorate very quickly. Technical judgments on the timing of a start are critical. . . .

"As we see the supersonic transport today—with an expenditure curve rising to $700 or $800 million before delivery of the first aeroplane to the airlines—the Boeing Company is clearly not prepared to undertake the development alone.

"It is arithmetic of that order which has inclined government,

RED TOP TRIALS.—To conduct field trials with the D.H. Red Top AAM guidance system, Short Bros. & Harland have modified this Canberra PR.Mk.9. Known as the Short SC.9 it will be used to gather infra-red data on various target characteristics in different environments, and to evaluate target detection systems.



TWO INTO ONE.—These pictures show stages in the operation of loading two F-104Gs into a Canadair CL-44. On the right, one of the two fuselages is lifted by the electric winches of a portable elevator (developed by Canadair) and its undercarriage is retracted. The elevator platform (seen in the picture on the left) and cradle are then added, and the fuselage is lowered on to the cradle, which is raised by the platform to sill height. Left, two sets of F-104 wings and tailplanes are loaded. The demonstration was arranged to show the ability of the Forty-four to airlift these fighters across the Atlantic.

as well as many in the industry, toward the view that government financing would be necessary to the development of the aeroplane. . . .

"If, hypothetically, we assume government participation our [Boeing] present judgment is that certain ground rules should obtain if the best results are to be secured:

"First, the airlines should be involved early in such a project and should play a decisive rôle in determining the character of both the project and its ultimate product.

"Second, any realistic evaluation would require direct comparisons of two or more flying prototypes. In a word, competition is the key to securing a superior product and this should be a competitive enterprise to the maximum extent possible.

"Third, each competing company should have a substantial financial investment in the project.

"And lastly, the government should keep itself removed from technical direction of the project.

"Competition in the aircraft industry is of the hard variety—we believe it produces the best results and we are not anxious to see it diminished. Nor are we anxious to see large amounts of government money invested now in hardware; the research problems should be given first priority.

"Our own experience tells us that whether to be first, or to be a close second with a superior product, is part of the challenge of the aircraft business, and the experience of the entire industry is that, in the short run or the long, the best aeroplane will dominate."

Overseas in Liquidation

OVERSEAS AVIATION (C.I.), LTD., one of the larger British independent airlines, applied to go into voluntary liquidation on Aug. 15. This move followed the action of the British Petroleum Company and Rolls-Royce, Ltd., who announced on Aug. 14 that they were petitioning for the compulsory winding-up of the company. On Aug. 13, B.P. had stopped all supplies of aviation fuel to this company.

According to the statement by the petitioners, Overseas Aviation (C.I.) owes B.P. about £250,000 and Rolls-Royce a comparable amount, respectively for fuel supplies and for engine repair and overhaul. The statement speaks of months of negotiation, during which time the debt had increased. Overseas had recently been paying B.P. £2,000 a day, but according to the latter company this only covered the daily fuel supplies and did not help to reduce the debt.

An examination of the trading position by "a firm of international accountants" indicated that the losses were continuing and, after taking legal advice, B.P. and Rolls-Royce decided that "in the interests of the travelling public and the other creditors, the matter should be brought to a head." Some of the conclusions in this auditors' report are challenged by Overseas Aviation (C.I.).

The company which is in liquidation is one of three of which Mr. Ronald Myhill is chairman; the others, not at present affected, are Overseas Aviation, Ltd., and Overseas Aviation Engineering (G.B.), Ltd. The parent company was registered in Jersey in February, 1958, with a nominal authorized capital of £5,000. The fleet of these companies totals 40 aircraft—15 ex-T.C.A. North Stars, nine ex-B.O.A.C. Argonauts, seven Vikings, five ex-B.E.A. Argonauts and four Doves. Only about half these aircraft have been operating in recent months, including some on lease-purchase by foreign operators. Others are leased by Overseas Aviation (C.I.) from Overseas Aviation, (Ltd.). The purchase of many of these aircraft was financed through Lombank, which is said to have some £200,000-worth of hire-purchase agreements with the company.

One immediate consequence of the liquidation move was that between 5,000 and 6,000 holidaymakers flown to European destinations by Overseas were stranded. As we went to press, arrangements were being discussed for another independent operator to use Overseas' aircraft to bring these passengers home, and B.E.A. and Cunard Eagle had offered to accept cheques or even I.O.U.s from returning passengers short of cash.

25 Years an Air Correspondent

RONALD SELBEY WALKER, 57, who died in London on Aug. 13, was an air correspondent of long standing. After journalistic experience in Australia he came to London and joined the *News Chronicle* in 1933, whose air correspondent he remained until 1956. Later he became air correspondent to the *Daily Express* until 1958.

As war correspondent he went to France with the A.A.S.F. later to North Africa and Italy. It seems unlikely that he learnt to fly, as some reports said, on a Farman biplane, in view of the fact that in the hey-day of this aircraft he would have been but a schoolboy. It seems that where he learnt to fly was at Reading in the 'thirties.

His friends will remember him as the gay and amusing companion which he knew well how to be.

Tragedy at Stavanger

LAST week's accident near Stavanger, Norway, was especially tragic because of the communal nature of the loss of life. A similar accident to an aircraft on scheduled service would have caused the same total of distress—but this would have had less of an impact because the victims would have come from different parts of the world. The 34 Croydon schoolboys and two masters, who, with the crew of three, were killed, came from a comparatively small community and from one school.

The Cunard Eagle Viking (G-AHPM) had flown from London and was about to be brought in on an instrument approach to Sola Airport, Stavanger. It had left Heathrow at 2.30 p.m. (B.S.T.) on Aug. 9 after a five-hour delay because of ignition trouble. The flight had apparently been routine, but the weather at Stavanger was poor, with rain and gale-force

FIFTY YEARS FLYING.—Since his first flight at the Bristol School of Flying in 1912 Lord Baillieu, president of the Dunlop Rubber Company and chairman of the English-Speaking Union, has flown more than one million miles. Lady Baillieu, then Miss Clark, flew with Henri Jullerot on the same occasion (right). Last week in London, (above l. to r.) Lord and Lady Baillieu were presented with commemorative plaques by Mr. G. W. Armstrong of United Airlines as was Miss L. E. Watson, personal assistant to Lord Bailleau, who acted as chairman of Fairey Aviation Company, from November 1943 to May 1945.

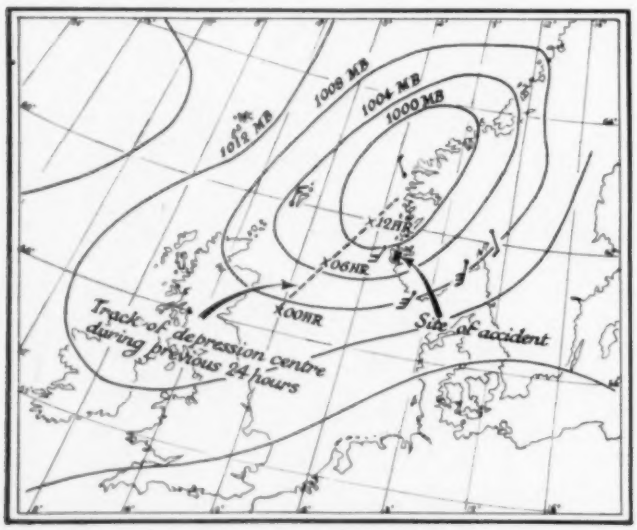
west winds, and, according to reports, there had been a fairly sudden 20-millibar drop (equivalent to 600 ft.) in barometric pressure.

The last message from the captain was to the effect that he was at 2,000 ft. and was going to make an instrument let-down. The Viking hit the summit of Holtahei mountain (1,800 ft.), which is about 21 miles north-east of Sola Airport.

Dr. A. E. Slater writes:—

At 18.00 hrs. on August 9, 35 minutes after last radio contact with the Viking, the weather chart showed a depression centred about 150 miles to the north and a S.S.W. surface wind of 20 knots at Stavanger. The spacing of the isobars, however, would have given a 50-knot "gradient" wind from S.W. at about 2,000 ft. at Holtahei, but from W.S.W. only 60 miles farther south.

Six hours earlier the Stavanger surface wind had been from S. by E., 25 knots, and the gradient wind would have been from about S. As the centre of the depression passed by less than 100 miles to the west, the wind would have veered rather quickly as the aeroplane was approaching Norway, and this could well be the reason why the pilot drifted to east of track. In addition, photographs of the wreckage show the sea down on the right, suggesting that the aircraft hit the mountain when flying from the N.E.; if so, there would have been the additional hazard of a strong downcurrent to leeward of the mountain.



A drawing, based on Meteorological Office charts, of the weather at 18.00 hrs. on Aug. 9 (see comments above).

Retirement from Vickers

THE aircraft industry loses one of its "originals" on Aug. 31 when the deputy managing director of Vickers-Armstrongs (Aircraft), Mr. T. Gammon, O.B.E., retires after more than 50 years of service in engineering. He has been associated with the Vickers group throughout his working life, serving his apprenticeship, completed in 1912, with the original firm of Vickers Sons and Maxim at Erith.

Armament was his first concern, in World War I and until 1938; he was Vickers' Dartford works manager for 19 years. Then followed a transfer to Weybridge where, early in 1940, he was appointed works manager. At that time Weybridge was fully geared for Wellington production. Other important wartime activities were that of vice-chairman of a region of the Emergency Services Organization which secured continuance of production despite enemy bombing and as a member of the M.A.P.'s London and South Eastern Regional Board for Industry. He was awarded the O.B.E. in 1953.

More latterly Mr. Gammon has been general manager at Weybridge at the time of the development and production of the Valiant and Viscount and in 1955 took up his present appointment. For several years he was a director of Vickers-Armstrongs, Ltd. He is a council member both of the S.B.A.C. and of Aircraft Research Association.

THE AEROPLANE'S First Backer

SIR VICTOR SASSOON, who died in the Bahamas on Aug. 12 at the age of 79, took an early interest in aviation. The obituary notice in *The Times* mentions his participation in the Grand Prix of the Aero Club of France in 1912 and his accident whilst serving with the R.F.C. in World War I. However, before that he had put up the money to form THE AEROPLANE, which started on Jne. 8, 1911. The story was told in "Bouverie Street to Bowling Green Lane" by the late Charles Grey, founder editor of THE AEROPLANE:—

"One day, as I was sitting in the Aero Club (not yet Royal), E. V. Sassoon (now Sir Victor), who at that time was running the Universal Aviation Company, jokingly known as the Universal Destruction Company, at Brooklands, purely as a philanthropic and sporting venture, remarked what a pity it was that the old blue-covered *Aero* had ceased as a weekly, and asked me whether another paper on the same lines was possible. I said that I thought it was if somebody would raise enough money to get it going. We talked it over, and he told me to go and find out how much would be wanted.

"After seeing various printers and publishers and block-makers, I came to the conclusion that with strict economy one could get such a paper going, and by the time one had lost about £1,000 it would probably be just paying its way. I took the figures to Sassoon, and he agreed to put up £1,000.

* * *

"Somewhere about the end of 1911, the senior directors of the Sassoon concern, very wisely according to their lights, told E. V. Sassoon that he had got to quit this silly air business, on which he had spent a lot of money, and settle down to steady business. At that time we had spent £600 of his promised £1,000. Very regretfully he had to obey the family's orders."

But by that time others had seen the possibilities and money was forthcoming from other sources.

OPtional Reading—7

SO United Research Inc. advises, in a private report made for the Harding Township, N.J., that New York will not need another airline airport by 1965! This reads strangely to me for two reasons. First, the date: if New York is not going to want a new airport in 1965, but is likely to do so in 1966, someone had better say so now and start to get on with the job. Secondly, it is difficult to see that the report has given enough weight to the air traffic control problem. It is one thing to work out the potential acceptance rate of a runway but quite another to work it out for an airway. In this connection much reliance appears to have been placed on progress towards automatic traffic control and the assumption made that the actual gains will be 50% of the potential. All I can say here is that it is a very good man who can say to what degree air traffic control automation will be practicable in 1965; to make a guess and then halve it is a very doubtful piece of mathematics.

The report does, however, contemplate the possibility of another airport for "general aviation," i.e., executive traffic and the like. This would, indeed, provide a great relief for the existing three airports. But would it provide any relief for the airways serving them? And would it help the airlines who now have to restrict their payload, or the pilots who have to take-off down wind in order to satisfy noise abatement procedures? And only the other day I heard of a jet held down for two hours before being given clearance to its cruising altitude. These are the fundamentals of the problem.

But unfortunately it is these problems for which one can see no practicable solution within 10 miles of New York; the fine fishnetting of the horizontal airways is a barrier which, radar assistance regardless, will always impede any free flow of traffic up to and down from the upper airways. The result after automation may well be, as it is now, holding en route as well as in the terminal area. Now the point here is, if one is going to have to add 40 minutes to the journey in order to comply with air traffic control requirements, would it not be cheaper for everybody to spend that 40 minutes on the ground proceeding to an airport 20 miles farther out from town?

And what an airport it could be! There would be a new rail (mono-rail?) link, with Customs on board (saving 25 of the lost 40 minutes), taking the passengers direct to the aircraft (saving the other 15 minutes) and dropping them and the baggage (already packed in containers) into top hatches of the jets, the latter having started their engines when the train drew in at the station. This procedure would be possible because the pilots would be assured not only of the time of arrival of the passengers but also of a direct air traffic clearance out and up. This is what might be provided at a site 30 miles from Manhattan—but not at one which is 10 miles distant.

A little way out the horizontal airways' fishnetting takes on a wider mesh and you can poke several good fishing rods through it. (I prefer to use the analogy of the fishing rod to convey the idea of a long tapering channel; in real life it would, of course, have a rectangular not a circular cross-section.) For each main jet route place the thin end on top of a VOR/DME facility 10 miles from the airport, the thick about 100 miles out in the general direction of the traffic, this end resting 18,000 ft. above a second VOR/DME station (or something better); the "rods" for each main route are in pairs, thin ends 10 miles on either side of the airport—and thick ends of each pair converging so as to be vertically over each other at the 100-mile point. The lower one carries the outbound traffic and need not expand more than 2,000-3,000 ft. vertically at the 100-mile station, nor be higher there than 18,000 ft.; climbing within this airspace the jet would not suffer any serious economic penalty. The "rod" above it carries the inbound traffic and would be somewhat deeper (6,000 ft.) at the 100-mile station—this, of course, to accommodate a variety of let-down rates.

To maintain adequate separation all you have to do is to keep each stream of jet traffic to its respective "rod" and keep the surrounding piston traffic to its horizontal fishnet. By suitably placing the thin ends of the "rods" you can provide a cushion of vertical separation for the outer portion of the terminal area and of horizontal separation for the inner. By a system of switching the direction of traffic and the corresponding "rods" you can arrange for most flights to have near straight-in landings and straight-out departures.

And what about the equipment for this? After all, it is somewhat tricky to base separation on an assumed rate of climb or descent: does the system depend on the installation of height-indicating radar? No, it calls for no new equipment on the ground; the only new equipment needed is in the air: this is a cockpit instrument to take feeds from the inner or outer VOR/DME facility and the altimeter and combine them to give a prescribed ascent or descent path. As a safeguard against altimeter mis-setting, etc., one would have a pencil-beam radar with a controller looking up each "rod" and another radar man would be needed to scare off any straying horizontal traffic—but on the whole the radar service would be purely monitoring, which is its natural function.

The only further suggestion I would make is that, when trying this during your holiday, the shrimp net can be used by bending the wire rim at right angles to the handle; but you should remove the end joint of the fishing rod before sticking it in the sand. Also, you do not restrict your thoughts to New York. Try Stansted.—C.C.J.

Since the above was written, and unknown at the time to the author, the Port of New York Authority has made available its own (semi-official) report on the future traffic capacity of its airport system. In the comprehensive volume just issued some 17 possible sites are surveyed and a prediction made of the handling capacity of the air routes. The latter indicates that they will indeed be swamped by 1965.

The conclusion invited is the establishment of a new airport (jets only?) at Morris County (44 min. by road from Manhattan), a site favoured mainly because of its ability to use a new set of traffic lanes which would give the minimum interference with the existing network. If P.N.Y.A. and the F.A.A. can together work out an oblique airway pattern, as outlined in the above article, it looks as if we will all agree.

Stewart Scott-Hall

MANY will join with us in mourning the untimely death in Melbourne on Aug. 4 at the early age of 56 of Mr. Stewart Scott-Hall, who had been head of the U.K. Defence Research and Supply Staff in Australia, and scientific adviser to the High Commissioner since the end of 1959. Appointed C.B. in 1950 he was Fellow of the City and Guilds Institute, of the Royal Aeronautical Society, of the U.S. Institute of Aerospace Sciences and of the British Interplanetary Society.

Educated at Eastbourne College, he went to Imperial College where he obtained his D.I.C. and an M.Sc at London University. He was Busk Memorial Scholar for 1925-26. He joined the Aerodynamics Department of the R.A.E. in 1927 as a Junior Scientific Officer. While there he had to jump (in September, 1929) from an A.W.A. Ape experimental aircraft (of which three were built), as did his pilot, Flt. Lt. David Bonham-Carter, who came down in time to see his machine crash close by.

From Farnborough he went to the A. and A.E.E., Martlesham Heath 1929-33; thereafter he was Resident Technical Officer, Vickers-Supermarine, Ltd., 1933-37; in charge, Orfordness Ballistics Laboratory, 1937-39; Technical Assistant to Director-General of Aircraft Production, M.A.P., 1940-41; Head of Armament Dept., R.A.E. Farnborough, 1941-44; Superintendent of Performance Testing, A. and A.E.E., Boscombe Down, 1944-46; Dir.-Gen. Technical Development (Air), 1946-52; Head M.o.S., Staff, B.J.S.M., Washington, U.S.A., 1953-56; Scientific Adviser to Air Ministry, 1956-59.

He became interested in gliding in the early thirties, having learnt to fly a few years earlier, and went to the German gliding contests in the Rhoen. This was characteristic of Scott-Hall's all-embracing interest in every aspect of aviation and he still found time to sail dinghies and later in life took up painting.

With the coming of aerospace activities, his enthusiasm extended to this new field and his letters from Australia had much to do with furthering the interest of the B.I.S. members there, particularly of the Victoria branch of which he was chairman.

Truly, his interests in aviation were catholic and there are many who profited by his enthusiasm. His strongly held views were generally kept to himself, though he did on occasion make known the wish that he were free to express them in writing, but professional considerations forbade it.

To his widow, Mrs. Peggy Scott-Hall, every sympathy will be extended.—T.J.

Pinch Plasma Engine

A U.S.A.F. contract for the construction of a compact battery-operated "pinch plasma" engine has been received by the Republic Aviation Corporation. Although details of the engine are classified, it is said that the unit will develop thrusts greater than those produced by other electrical space propulsion systems under development.

The "pinch plasma" engine uses readily available inert gases for fuel. The fuel becomes ionized after injection into the engine and the resultant plasma is electromagnetically accelerated to form the propulsive exhaust. Gas velocities exceeding 100,000 m.p.h. and ejected gas temperatures in the range of 200,000° F. have been measured, yet wall temperatures of 200 to 300° F. are maintained without the need for auxiliary cooling.

The Republic engine will be completely "packaged," with its own battery power and fuel supply.

Aviation News in General

JETS FOR KUWAIT.—Like the Sudan, Kuwait has ordered the Jet Provost to form the nucleus of its air force. The £500,000 plus contract signed between the Kuwait Government and Hunting Aircraft is for an undisclosed number of aircraft (probably the armed T.51 version), spares and initial maintenance and operating contracts.

F-105 CAPABILITIES.—During a demonstration of its limited-war capabilities an F-105 Thunderchief has carried more than seven tons of conventional bombs, composed of 26×565 lb. bombs on wing and belly racks, to its target. This is claimed to be the largest load ever airlifted by a single-engined fighter. In another demonstration four F-105s dropped more than two tons of napalm.

HEIGHT RECORD.—A new World's altitude record in the C-1-d Group 1 Class is being claimed for a Macchi MB.326 basic trainer which on Aug. 4 reached 50,024 ft. It was flown by Cmdt. G. Carestiato, Macchi chief test pilot. The MB.326 is powered by a Bristol Siddeley Viper 22 turbojet of 2,500 lb. thrust.

LONG-RANGE HERCULES.—The first C-130E Hercules for MATS has been rolled out at Lockheed's Marietta plant. This is an extended-range version of the C-130B, having two 1,360-U.S. gal. underwing tanks to give the aircraft a total fuel capacity of 9,680 U.S. gal.

U.S. DEFENCE TEST.—About 15 V-bombers are reported to be taking part in the U.S.A.F.'s Exercise Sky Shield II over the whole of North America on Oct. 14. During the 12 hr. period of the exercise there is a ban on all movements by private and commercial aircraft.

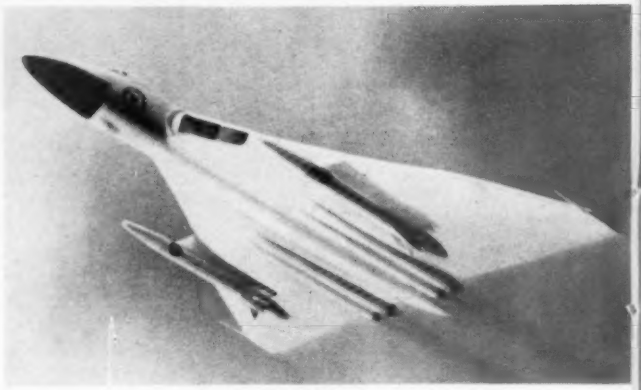
PACIFIC U-2s.—The U.S.A.F. has confirmed that Lockheed U-2s are to be used on high-altitude weather reconnaissance flights over the western Pacific. From Naha A.F.B., Okinawa, the flights will be over international waters and the aircraft will be clearly marked with usual U.S.A.F. insignia.

CHANGES AT DOUGLAS.—Two new integrated divisions—one for missiles and space, with headquarters at Santa Monica, and the other for military and commercial aircraft, at Long Beach—have been set up by Douglas Aircraft as the result of large-scale organization structure changes. The company's Charlotte, N.C., division continues as production centre for the U.S. Army's Nike Hercules and Honest John missiles and the Tulsa, Oklahoma, division will remain the Douglas modification centre.

PT6 PROGRESS.—Canadian Pratt & Whitney's PT6 500-h.p. free turbine has completed the official 50-hr. preliminary flight-rating test to the specification requirements of the U.S. Navy. This qualification clears the engine for operation in prototype aircraft installations and generally precedes series production of the engine by about a year. Formal military approval is expected in the near future.

LUTON EXHIBITION.—We understand that the International Light Aircraft Exhibition which was to have been held at Luton Airport on Aug. 29-Sept. 2 and is noted in the Aviation Calendar on page 192 will now not take place.

GERMAN ROCKETRY.—A 10-ft. long two-stage meteorological rocket is to be launched near Cuxhaven by the German Rocket Society on Sept. 16. The rocket, Cirrus, has a diameter of 5 in., weighs 132.5 lb. and will be fired to an altitude of 50 miles. A second containing an instrument package will be launched towards the end of the year.



SKYBOLT VULCAN.—An impression of a Vulcan B.2 as it will appear with two Skybolt ALBMs. As recorded in our Aug. 3 issue, A.E.I. is to manufacture the conversion equipment necessary to make the Vulcan's navigation and bombing equipment compatible with the missile's guidance system.

BIG SKIS.—The Antonov design bureau has developed skis for the An-10 transport, to permit its operation in the Arctic. In a two-month series of trials, the first ski-equipped An-10 made seven trips to the North Pole-8 drifting station.

Wind of change.

NEEDLING.—The U.S. project to put millions of fine "needles" in orbit around the Earth as part of a radio communication experiment is to go ahead despite opposition from astronomers and other scientists. The scheme—Project West Ford—is to launch a space vehicle carrying 75 lb. of "needles" 1/1,000th. in. thick and less than one inch long. They are to form a band 24 miles wide and five miles deep at an altitude of 2,000 miles. The band would act as a "mirror" to radio signals far superior to the ionosphere, according to U.S. authorities.

SPACE RELICS.—A Space Museum is to be built at Kaluga, the town where Konstantin Tsiolkovskii (1857-1935) lived and worked.

ROTOR FORMATION.—Eight Sycamores, two Whirlwinds, a Dragonfly and a Skeeter make up this formation from the C.F.S. Helicopter Wing which on Aug. 10 moved from R.A.F. South Cerney to its new base at Ternhill. The Wing has a total of 14 machines.

Commercial Aviation Affairs

NORTH ATLANTIC TRAFFIC.—IATA statistics show an increase of only 4.5% in North Atlantic traffic for the second quarter of this year. Seating capacity on the route increased by 47.3% and the average passenger load factor fell by 20.6 percentage points. The traffic increase for the first half of the year is 12.3%.

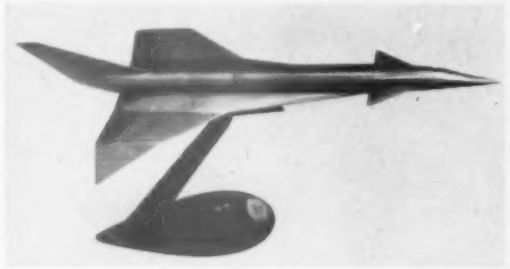
B.E.A. COMETS DELIVERED.—Nearly two months ahead of contract date, the 14th and last Comet 4B for B.E.A. was delivered on Aug. 4. It went into immediate service to help handle the 150,000 passengers flown by B.E.A. in the week ended Aug. 5.

BOEING ORDER.—Northwest Orient Airlines has concluded a contract to buy one more Boeing 720B and to lease two others from Boeing, making a total fleet of nine of these transports. Four are already in service.

TURBOFAN DELIVERY.—The first Boeing 707-138B for Qantas was delivered across the Pacific on Aug. 6, setting a record for the Honolulu-Sydney leg of 14 hr. 46 min. Named "City of Darwin" it is the first of four new turbofan-powered Boeings ordered by Qantas. The remainder of the fleet is to be re-engined.

K.L.M. RESULT.—A loss of 37 million guilders (£3.7 million) was recorded by K.L.M. in the first half of 1961, compared with 3 million guilders in the first half of 1960. Introduction of new jets and the shortfall in North Atlantic traffic are blamed.

CAIRO-MOSCOW.—United Arab Airlines have started a once-weekly Comet 4C service linking Cairo with Moscow. Services to Karachi and Bombay are planned.



DOUGLAS IDEA.—Among the supersonic transport projects under study in the U.S., the Douglas Model 2229 is shown here. It is designed for Mach 3 transatlantic operation with 100-130 passengers. The wing tips are drooped for high speeds, straight for low speeds.

FRIENDSHIP ORDER.—Two Fokker F-27s have been ordered by the Angolian airline, DTA, for delivery in the second half of 1962. This order is not to be confused with that recently concluded by the Mozambique airline, DETA.

T.W.A. LOSS.—In the first half of this year, T.W.A. recorded a loss of $11.7 million (after taxation), compared with a small profit in the first half of 1960.

FUEL CUT.—The British Petroleum Company stopped supplies of aviation fuel to Overseas Aviation at midnight on Aug. 13. The decision, reported to have been taken in view of a large debt to the company for fuel already supplied, was notified during the afternoon of Aug. 11 and resulted in some disorganization of holiday flights from Gatwick by Overseas last week-end.

THE (VERY) LAST PIONAIR.—Astreus, Ltd., inform us that they are, in fact, the purchasers of the last B.E.A. Pionair (G-AJHY). North-South Airlines, as reported in our issue for Jly. 27, had previously purchased G-ALXK for its scheduled operations from Leeds/Bradford Airport.

LUFTHANSA INTEREST.—The pressurized MH262 Super Broussard is being evaluated by Lufthansa for possible use on domestic routes in 1963. A presentation on the Armstrong Whitworth Argosy was completed for Lufthansa in Hamburg last month. The German airline is expected to need a freighter for European routes in due course.

TEST-BED CENTURY.—Sabena's turbojet test plant notched up a century on Jly. 7 when the 100th P. & W. JT-4 from one of the airline's Boeing 707-329s underwent test. The plant is now being modified to take the Avon 531s which power Sabena's Caravelle VIs.

MALEV ACCIDENT.—All on board—20 passengers and a crew of four—were killed when a Malev airliner crashed in a Budapest suburb on Aug. 6. The aircraft was a DC-3 used for summer sightseeing flights.

ALL-CARGO.—Seaboard World Airlines' first CL-44 is seen here on the apron beside the new cargo warehouse (see issue of Jne. 29, page 761) at Heathrow after its second flight into London. Seaboard's CL-44s are now being absorbed into the daily transatlantic schedules.

News About People

SAFETY APPOINTMENT.—Lord Brabazon has accepted the invitation of the Minister of Aviation to become the chairman of the Air Safety Board. He succeeds Air Marshal Sir Charles Guest, who has retired from his appointment as chief aeronautical adviser to the Minister.

R.-R. RESIGNATION.—Air Marshal Sir Colin W. Weedon has resigned as director and general manager, commercial sales, of the Rolls-Royce aero-engine division, but is to remain with the company as a senior aero-engine representative. In this capacity he will be based at the Rolls-Royce Conduit Street, London, offices.

RADAR SPECIALIST.—One of John Logie Baird's assistants at the very beginning of television, Mr. J. D. Percy has been appointed technical sales manager of Cossor Radar and Electronics, Ltd. Previously he was the company's controller (administration) technical division.

MINISTERIAL ASSISTANT.—Mr. D. A. Lovelock has been appointed principal private secretary to the Minister of Aviation, Mr. Peter Thorneycroft.

PROMOTION.—Mr. G. F. Laurence, technical services director at Metalastik, Ltd., the Leicester rubber suspension and rubber-bonded-to-metal component manufacturers, has been appointed a deputy managing director of the company.

BRISTOL TO EPSYLON.—Mr. G. D. Taylor has joined Epsylon Industries, Ltd., as chief applications engineer, from the Bristol Aircraft Co., where he was head of the flight research department.

A.-M.P. APPOINTMENT.—Mr. G. H. J. Munro has been appointed director and general manager of Aircraft-Marine Products (Great Britain), Ltd. He joined the company in 1957 as sales manager. Next month a new A.-M.P. factory is to be opened at Port Glasgow by the Secretary of State for Scotland.

CHIEF ENGINEER.—Formerly an engineering consultant with the Sperry Gyroscope Co., Ltd., Mr. R. Hadekel has joined Trico-Folberth, Ltd., screen-wiper and washer manufacturers, as chief engineer.

EMPLOYMENT STATISTICS.—Persons employed in the manufacture and repair of aircraft during May totalled 298,400. This was 700 more than in the previous month and 14,100 up on the May, 1960, figure.

Air Transport

Independent M.E.A.

MIDDLE EAST AIRLINES is to become a wholly independent airline. This news was given in the following bald statement from B.O.A.C. last Thursday, Aug. 10:—

"As a result of discussions regarding the future relations between B.O.A.C. and M.E.A., the chairman of B.O.A.C., Sir Matthew Slattery, and Sheikh Najib Alamuddin, chairman of M.E.A., have agreed to the Sheikh's suggestion for the sale of B.O.A.C.'s 48.5% shareholding in M.E.A. Both chairmen feel that the future of M.E.A. will be best assured by this arrangement which will result in M.E.A. becoming a completely independent Lebanese airline. The long-standing close commercial and technical co-operation between the two airlines will continue."

Thus concludes a somewhat turbulent six-year relationship between the British corporation and the Lebanese airline which was founded in 1945 with a 36% participation by Pan American. B.O.A.C. took over and expanded the Pan American interest in 1955. Conditions in the Middle East in 1958 combined with the need to re-equip and other local problems to give M.E.A. a net loss of £1,727,201 in the 1958-59 year. A small profit was recorded in 1959-60, but the B.O.A.C. Report and Accounts for 1960-61 shows a loss in respect of M.E.A. of £134,312.

In 1959, an offer to buy out the B.O.A.C. interest was made by M.E.A., but neither this nor a counter-offer by B.O.A.C. was accepted, and a new agreement was concluded on Nov. 20 of that year, setting out the respective responsibilities of the two airlines and specifying the financial assistance to be given by B.O.A.C.

Since then, M.E.A. has been increasingly concerned about the competition offered by B.E.A. and its associated companies in the Middle East. As B.E.A. flies these services in agreement with B.O.A.C., it has been impossible for M.E.A. to fight effectively. The background to this situation was discussed in our issue for Feb. 24 this year, when Sheikh Najib Alamuddin's interest in a Pan-Arab airline was also noted. The large British interest in M.E.A. would have been embarrassing in any moves towards such a union of the Arab airlines.

The value of the B.O.A.C. holding in M.E.A., together with various advances which have been made, is put at more than £3.6 million. This sum will be raised through Lebanese banks and other commercial interests.

American's 727s

AMERICAN AIRLINES' announced intention of purchasing Boeing 727s became a fact on Aug. 10 when the contract for 25 of these triple-jet transports was signed. The cost, including related equipment, is given as $131.5 million and will be covered by the airline without additional financing. Deliveries are scheduled for 1964-65.

These 727s will join American Airlines' present fleet of 49 Boeing 707 variants, and the 25 Convair 990s to be delivered next year. They will be used to serve many cities on American's routes with airports not at present able to accommodate the larger jet types.

American plans to use its 727s in a dual class layout, with provision for individual temperature control between areas of the cabin regardless of seating arrangements. Transistorized VHF communication and navigational equipment is to be used.

A new impression of the Boeing 727 in American Airlines' markings. A contract for 25 of these triple-jet transports is noted on this page.

Boeing now has orders completed or under negotiation for 117 Model 727s, now described by the makers as a "compact" jet transport. This term has been coined for the smaller aircraft designed for short-to-medium ranges, as distinct from the existing large-capacity types which can be used over similar ranges and the strictly short-haul types now being developed.

Something Different for the A.T.L.B.

AT least one of last week's sessions of the Air Transport Licensing Board must have given its members something new (and perhaps more interesting) to think about. On the afternoon of Aug. 8 Channel Air Bridge applied for leave to operate its proposed deep penetration vehicle-ferry services, with ATL-98 Carvairs, between Southend and Basle and Geneva.

The application was—by comparison with those for the North Atlantic and for European and U.K. passenger-service networks—a comparatively minor one and the objections from B.E.A. were no more than "mild." But the principles involved were quite important and the applicants put a good deal of strength into the presentation of their case—so much so that an onlooker might have described the operation as one of using a sledge-hammer to crack a rather small nut.

With support from a practical selection of witnesses from different sections of the travelling public (including the R.A.C. and the A.A.) the case for Channel Air Bridge included the facts that there appeared to be a reasonably sympathetic attitude on the part of the Swiss Government and that the service would offer useful and much-needed cargo capacity.

B.E.A.'s objection was principally related to the terms of the application—with its mention of "supplementary passengers." If, the argument went, there was a poor response from vehicle owners and operators, then the number of supplementary passengers might constitute a sizeable diversion from the Corporation's normal passenger services.

The Channel Air Bridge case document offered some informing studies of motorists' travel habits and of the relative advantages of taking a motorcar or hiring one at destination. The most popular country for British motorists is France—which, according to answers to questionnaires, is the destination for 28% of private vehicles; Italy (16%), Switzerland (15%) and Germany (12%) follow.

The study showed that the cost, to a driver and two passengers, of a journey by Channel vehicle-ferry and road to and from Geneva, with a 1,600-mile tour, might reasonably be £78 exclusive of accommodation while on tour. The cost of three return airline tickets and of hiring a car for a similar tour might amount to £176, and the cost of the tour when the car is flown all the way to and from Geneva worked out at about £140. Another sum showed that it would be cheaper to fly the car out than to hire one if the duration of the tour were to be seven days or more.

The loading elevator designed for use with the Aviation Traders Carvair was used recently for trials with the prototype aircraft, which is continuing to make excellent progress with its flight test programme.

Choice of Heliports

The final selection of three heliport sites for London as seen from a B.E.A. Westland Whirlwind. The approximate extent of the areas of the proposed heliports is shown in white outline.*

*See our issue of Aug. 3, pp. 124 and 126.

Above, Cannon Street Station site in which the available area of the roof might be extended by a platform along the east side of the station and, later, along the river's edge.

Left, the St. Katharine Docks site. A 50-ft.-high platform might be built over the approximate area shown, leaving space below for terminal facilities and warehousing.

Right, the Nine Elms "B" site might have a platform covering the North Goods Depot, spanning Nine Elms Lane and over an area beside the river.

Air Transport . . . .

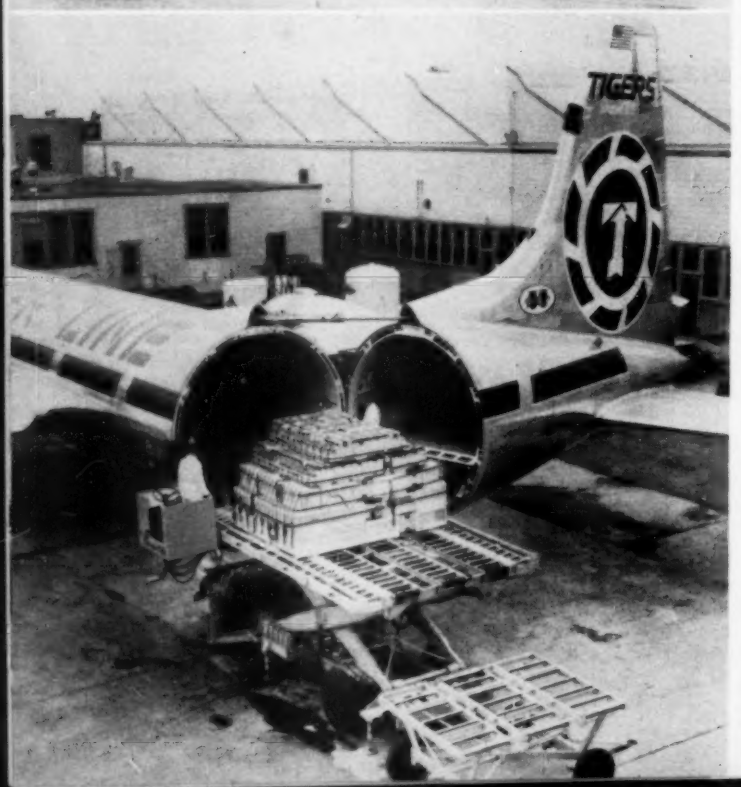
Cracks in the Bermuda Agreement

THE interpretation of the (controlled free-for-all) principles of the 1946 Bermuda agreement seems to be at the root of the differences between K.L.M. and Pan American.

On Jne. 12 P.A.A. lodged a complaint with the U.S. Civil Aeronautics Board in which K.L.M. is accused of violating the 1957 bilateral air agreement between the U.S.A. and the Netherlands. P.A.A. objects to the capacity provided by K.L.M. on the routes to the U.S.A. which—in view of the provisions of the agreement as interpreted by Pan American—is said to be much too large. The C.A.B. gave K.L.M. until Jly. 31 to reply to the complaint.

K.L.M. has now said that it opposes the possible institution of proceedings by the C.A.B.—partly on the ground that the Board has no power to take unilateral action in a question which is expressly reserved to the governments under the terms of the agreement. K.L.M. also states that procedures are explicitly laid down in the agreement to meet the case of a difference of opinion between the parties as to the interpretation or application of the agreement. Handling of this matter by the C.A.B. would therefore be contrary to the agreement. It would mean, in effect, that the Netherlands Government was being blamed for knowingly or unknowingly permitting a breach of the agreement by K.L.M.

According to K.L.M., Pan American's complaint is based on an interpretation of the Bermuda principles, embodied in the agreement, which differs from that of the Dutch. The Netherlands interpretation agrees with that which was accepted at the time when the Bermuda principles were drawn up between the U.S.A. and the U.K. in 1946. Since then, K.L.M. says, the U.S.A. has apparently concurred in this interpretation and no other interpretation was agreed when the Dutch-U.S.A. agreement was concluded in 1957.



Best Year for Irish Airlines

WITH a total revenue of £7,298,000 for the 1960-61 financial year, Aer Lingus and Aerlinte Eireann had, between them, the best results in their history.

Aer Lingus' revenue was £4,919,000, or about £1 million more than for 1959-60, and expenditure was £4,642,000, leaving a surplus of £277,000. A total of 690,964 passengers were carried on scheduled and charter flights—a 25% increase on the previous year. Cargo carryings increased by 39% from 8,617 to 11,952 tons. The overall load factor was 71%.

The transatlantic division of Irish International Airlines, Aerlinte Eireann, carried 35,176 passengers (an increase of 51% on 1959-60) and revenue increased by 45% to £2,379,000. The airline had the highest westbound load factor (71%) of all the 15 carriers operating between Europe and the U.S.A. The two-way North Atlantic load factor was 65%.

B.O.A.C. and the Atlantic Decision

AN outline has now been given of B.O.A.C.'s case in its appeal against the A.T.L.B. decision to grant a 15-year licence for North Atlantic services to Cunard Eagle Airways.

At the hearing of the appeal B.O.A.C. will be entitled to offer new evidence and will, using the wording in the Corporation's weekly staff publication, *B.O.A.C. News*, "wish to produce figures relating to the current season's North Atlantic traffic, which has fallen far short of expectation. As a result, it would seem that the forecasts on which the Licensing Board's decision is based are likely to prove over-optimistic.

"A second ground of appeal is that the A.T.L.B.'s decision is, in a number of respects, inconsistent with the evidence given at the hearing and indeed, in some cases, inconsistent with the A.T.L.B.'s own findings of fact.

"A further ground of appeal is that the Licensing Board's decision will not further the development of British civil aviation as is required by the Act.

"A final ground of appeal is that the Licensing Board has misconceived its functions under the Act."

The hearing will start on Sept. 26 at the Holborn Town Hall and will be in public; Sir Fred Pritchard, a retired High Court judge, has been appointed Commissioner. He will make his recommendations to the Minister of Aviation. These must, according to the Licensing Act, be published by the Minister—who must also make public his reasons if all or any of the recommendations are rejected.

U.K. Airports in May

THE number of passengers handled at U.K. aerodromes during May was 1,111,004, or 28% more than in the same month last year. The number of aircraft movements rose by 18% to 40,938. Freight showed an increase of 17% to 30,888 short tons picked up and set down.

The Ministry of Aviation figures show that in the London area there was an increase of 16% in air transport movements and of 22% in the number of passengers handled.

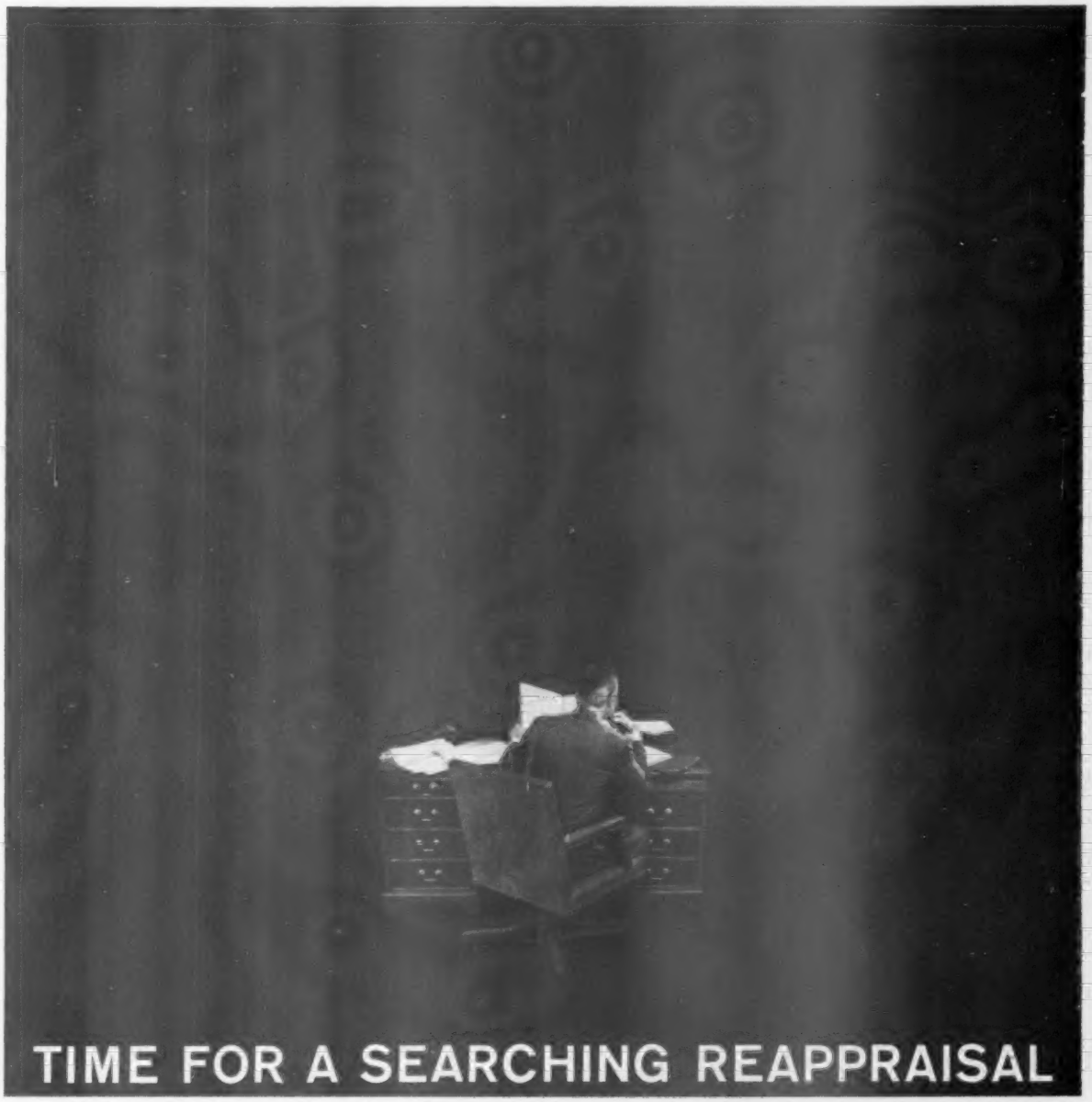
Co-ordination in Brazil

THE proposed participation of REAL and Varig in Aerovias Brasileiras (a jointly owned subsidiary for international operations) has now been approved by the President of Brazil.

In a recently issued communique by REAL, Varig and Panair do Brasil it was also stated that the basic services of the three companies were to be co-ordinated with a view to setting up, "in the near future," a single private company which would represent Brazil in all international airline operations.

The statement mentioned approval for the immediate reorganization of Panair and the modernization of the fleets used on Brazilian international services. At present Varig has two 707-441s, Panair has two DC-8s, and REAL is due to take delivery of three Convair 990s.

INTO SERVICE.—Flying Tiger Line and Seaboard World Airlines have put their first Canadair CL-44s into service. The pictures on the left show (above) Flying Tiger's CL-44 arriving at New York International and being loaded at Burbank Airport, California.



TIME FOR A SEARCHING REAPPRAISAL

In the light of current developments in air cargo, we challenge you to consider this statement. The time has come to make a searching reappraisal of air freight operations if they are being conducted with obsolete piston-powered passenger aircraft that have been converted for cargo. We are convinced that these aircraft, although they may still represent a multi-million dollar book investment, should now be disposed of, notwithstanding current market prices, and replaced by the modern all-cargo Canadair Forty Four. Inevitably, the disposal will result in a "profitable loss," because it can be shown that the Forty Four is the only all-cargo aircraft able to operate at a profit, either domestically or internationally, under the new low freight rates and will recover in a short period of time the losses incurred on the sale of the outmoded converted equipment. Any General Dynamics or Canadair official would welcome the opportunity to discuss this in more detail.

CANADAIR LIMITED, MONTREAL—A SUBSIDIARY OF GENERAL DYNAMICS

Please address enquiries to European Representative: John Winterburgh, Canadair Services Limited, Princes House, 190 Piccadilly, London W.1., England.

Ad. No. CUK-61-1

D

Crown Copyright

£1,200,000 EXPORT CONTRACT FOR NEW COMPANY

Formed only two months ago, by Napier, English Electric and Rolls-Royce, Napier Aero Engines Limited have already obtained an order worth one million, two hundred thousand pounds. They are to supply Gazelle free-turbine engines for 27 new Westland Wessex Mk. 31 Helicopters for the Royal Australian Navy – together with spares and support equipment.

NAPIER AERO ENGINES LTD

ROLLS-ROYCE – ENGLISH ELECTRIC · 211 THE VALE · ACTON · LONDON · W3

The Fighting Services

Chief Information Officer

AIR COMMODORE J. BARRACLOUGH, C.B.E., D.F.C., A.F.C., is to become Chief Information Officer at the Air Ministry next month. He will succeed Air Vice-Marshal G. A. Walker, C.B., C.B.E., D.S.O., D.F.C., A.F.C., who, as already announced, has been appointed A.O.C.-in-C., Flying Training Command, with the acting rank of Air Marshal.

Joining the R.A.F. in May, 1938, Air Cdre. Barraclough spent the early part of the 1939-45 War flying Sunderlands, first with No. 240 Squadron and afterwards with No. 209 Squadron in the Mediterranean area. Since 1945 he has undertaken flying and air staff duties at home and abroad, later commanding successively Biggin Hill and Middleton St. George. He is at present serving as senior operations and training officer at Headquarters, Far East Air Force.

Defence Appointment

AIR VICE-MARSHAL D. R. EVANS, C.B., C.B.E., D.F.C., who has been Commandant of the School of Land/Air Warfare, Old Sarum, since May, 1959, is to become Assistant Chief of Defence Staff at the Ministry of Defence in October.

C.O. of the Telecommunications Flying Unit at Defford from 1946 to 1948, Air Vice-Marshal Evans was later Group Captain in charge of plans of Headquarters, Fighter Command. He then became a Director of Operational Requirements at the Air Ministry and took the 1956 course at the Imperial Defence College. Prior to his present post he was S.A.S.O. at Fighter Command.

New Look for Tengah

THE conversion of R.A.F. Tengah, Singapore, into a Class 1 station has now been completed. The engineering work was undertaken without any major interruption of normal activities and this Far East Air Force base is now capable of dealing with any type of current Service aircraft and can provide full servicing and accommodation facilities by day and night.

When it was decided that Tengah should become a Class 1 station the first requirement was the laying of a new 9,000-ft. runway, 150 ft. wide, from which V-bombers could operate. This work was started in November, 1959, and completed in March of this year. Arrester barriers have been installed at both ends of the runway, which has wide shoulders and 600-ft. overshoot and undershoot areas at each end. There are also new taxi-tracks and hard standings for aircraft.

The extra facilities required by a Class 1 station have necessitated the building of a new air-conditioned operations block, electronics block and control tower. Further operational improvements are planned to be completed in September of next year.

Since it first came into operation in August, 1939, Tengah has undergone many changes. Between February, 1942, and September, 1945, it was occupied by the Japanese, and when the R.A.F. returned it was found that the 1,400-ft. runway was unusable. It had been deliberately built badly by the prisoners of war, mostly from Australia and the United Kingdom; depressions appeared in the surface because they had failed to pack the filling tightly; slopes and falls caused considerable embarrassment to Japanese pilots landing and taking off. Soon after the Japanese evacuation the R.A.F. laid a new runway, which has been used by Vampires, Meteors, Canberras, Lincolns and other types.

Currently based at Tengah is No. 60 Squadron (Wg. Cdr. P. Smith, M.B.E.), an all-weather unit which until recently flew Meteor NF.14s but is now being re-equipped with Javelin FAW.9s. This Squadron is shortly to be joined by another—No. 20—which is being reformed and equipped with Hunter FGA.9s. Hunter and Javelin flight simulators are installed.

The C.O. of the station when the conversion programme began was Gp. Capt. J. E. S. Morton, D.F.C., who saw the new runway built and brought into operation, but he is being succeeded this month by Gp. Capt. T. R. Pierce, until recently Deputy Director of Operations (Bomber and Reconnaissance) at the Air Ministry.

SUMMER CAMP.—Glasgow University Air Squadron has recently completed its summer camp at R.A.F. Horsham St. Faith. Here Sir Hector Hetherington, Principal and Vice-Chancellor of the University, who visited the squadron at camp, is seen at R.A.F. Coltishall with Flt. Lt. M. J. Williams of No. 74 Squadron, a former member of Glasgow U.A.S.

TIGER SQUADRONS.—At U.S.A.F. Woodbridge last month there was an informal gathering of three "Tiger" Squadrons of the R.A.F., U.S.A.F. and the French Air Force. Seen here are (left to right) Maj. F. L. Dowell, No. 79 Sqn., U.S.A.F. (F-100s); Capt. Achille Lerche, No. 01/12 Escadrille de Chasse (Mystères); and Flt. Lt. T. J. Nelson, No. 74 Sqn., R.A.F. (Lightnings).

R.A.F. Appointments

THE following are among recent Royal Air Force appointments:—

Air Ministry: Wg. Cdr. A. J. H. Kitley, Wg. Cdr. G. A. Mason, D.F.C., and Sqn. Ldr. D. J. Harper, A.F.C., with acting rank of Wg. Cdr., to the Department of the Chief of the Air Staff.

Technical Training Command: Sqn. Ldr. J. D. Watson to Record Office, Gloucester, for work study duties, with the acting rank of Wg. Cdr.

Maintenance Command: Wg. Cdr. H. R. Johns to Headquarters for work study duties; and Wg. Cdr. J. G. Pearse to Headquarters for organization duties.

Royal Air Force Germany: Gp. Capt. R. J. Gosnell, D.S.O., D.F.C., and Wg. Cdr. L. G. Press, A.F.C., to Headquarters for staff duties and flight safety duties respectively.

Other Appointments: Wg. Cdr. W. S. Northcott, D.F.C., and Wg. Cdr. G. J. Storey, O.B.E., A.F.C., to Maxwell Air Force Base, U.S.A., on exchange posting.

More Service News

Remembrance Service.—This year's Battle of Britain thanksgiving service will be held in Westminster Abbey on Sunday, Sept. 17 at 15.00 hrs. Applications for tickets should be sent to the Air Ministry (S.4c), Whitehall, S.W.1, in writing not later than Sept. 1.

R.A.F. Recruiting.—More than 22% of all entries into the R.A.F. during the three months ended Jne. 30 came from former members of the A.T.C. and of R.A.F. Sections of the Combined Cadet Force. Recruits from all sources during this period totalled 2,701, of whom 597 were former air cadets.

No. 208 Squadron Reunion.—The annual reunion of the No. 208 Squadron (formerly Naval 8) Old Comrades Association will be held at the Swiss Hotel, Old Compton Street, London, W.C.1, on Oct. 28. Further details from the Hon. Sec. Mr. R. W. Booker, 18 Blacksmiths Crescent, Sompting, Sussex.

R.A.A.F. Neptunes.—The rearming of No. 10 (M.R.) Squadron at R.A.A.F. Richmond will start in January, 1962, when three Lockheed P2V-7 Neptunes will be flown across the Pacific. Ferry flights from the United States will then continue at the rate of three each month, and by April, 1962, all 12 aircraft will have been delivered.

As an Aero Commander takes off for the distance event of the recent International Business and Touring Aircraft Competition, the Cessna 185 Skywagon awaits its turn to be marshalled out.

Touring the Cessna Skywagon

by John Fricker

WITH four adults on board, plus full fuel of 51.6 Imp. gal. in the two wing tanks and no less than 450 lb. of sandbag ballast in the rear cabin, the beefy Cessna 185 lifted skywards like a young Beaver at the drop of Philip Mayne's flag at Kidlington. "Try 066 for Seething" from navigator/co-pilot Bev Snook, a gentle climbing turn to feel out the handling at our computed weight of 3,166 lb.—just a fraction short of the 3,200-lb. max. gross—and we were off on the first leg of the 1961 International Business and Touring Aircraft Competition.

Cruise-climbing briskly at 110 m.p.h. into the clear air of post-frontal weather up to 2,500 ft., to seek some advantage from the forecast north-westerly winds, I relaxed after take-off. This had been my first in the Skywagon at anything near full load, but the 185 had gone like a bird, and I settled down for the long 625-mile flight round southern England that lay ahead. I was beginning to get to know and like this six-seat Cessna, the biggest of the company's single-engine range, after an acquaintance which regrettably had started only three days before the reporting time for the competition at Oxford Airport.

The 185, G-ARMJ, and the first of its type to reach the U.K., had arrived a week or so before by sea from the U.S., and had been uncrated and assembled by Airwork Services, the U.K. Cessna agents, by whom it had been entered. It was by no means certain that the C. of A. validation would be through in time, so that a stand-by, in the shape of one of the smaller Cessnas, was a useful precaution. After one test flight, however, all was well and the 185 was handed over to me at Panshanger on Jly. 24 to practise for the touring event starting on Jly. 28.

I had hoped to fly some consumption checks and to try some short take-offs and landings, but because of the shortage of time and intervening bad weather, I had managed to put in only a couple of hours with it at a light weight before loading up the ballast to fly to Oxford. With the ample power reserve from the 260-b.h.p. Continental IO-470 fuel-injection engine, it was clear from the start that the 185 was a real weight-lifter, and the main effect of increasing the load seemed simply to improve the handling still further.

As it combines a six-seat capacity with the clean airframe and excellent short-field performance of the rest of the Cessna range, the Skywagon seemed a natural choice for the Business and Touring Competition. In the distance event of this contest points are awarded to a formula multiplying a.m.p.g. × block speed × the number of seats occupied and the 185 promised to do equally well in the second half of the flying section, which was take-off and landing over a 10-ft. tape.

Basically a utility aeroplane and a development of the well-proven Model 180, the Skywagon could not be expected to do so well in many points of interior detail against the true executive and touring types and quite a few marks were, in fact, lost on this score. In particular, by declaring the 185 as a six-seater, to take maximum advantage of the formula, very little baggage space was left, since the rear bench seat is positioned in what is the luggage bay in the lower-powered Cessnas. This seat is of the tip-up type, leaving ample space and payload for freight and baggage when only four persons are carried, and the normal external loading hatch is retained.

It seems a pity that this hatch could not be extended upwards to take in the extra window provided for the rear seats, and thereby provide another passenger door. At the moment, the normal two-door arrangement of the standard Cessnas is retained, with the back of the middle two seats folding down for access to the rear cabin when six passengers are carried. Dimensionally, the 185 is the same as the other four-seat Cessnas in almost all respects, so that its lifting ability usually exceeds its internal capacity.

It is therefore difficult to overload the Skywagon, as we found when ballasting it up to meet the contest requirement of a 160-lb. passenger and 20 lb. of baggage weight per seat. Our actual direct payload, excluding full fuel, oil and equipment, was 1,072 lb., or the equivalent of nearly seven 160-lb. persons. To make the fullest use of its weight-lifting ability, the Skywagon is therefore being offered with a large detachable cargo pack beneath the centre fuselage. In standard form, the starboard front and all four rear seats are quickly removable for the carriage of freight. Plenty of tie-down points are provided and the cabin floor is stressed to take a load distribution of up to 200 lb./sq. ft.

Despite its utility appeal, the Skywagon is furnished internally to the same high standards as the rest of the range, except for the sparser rear seats, and is correspondingly comfortable. Instrument and control layout is to the standard Cessna pattern, with centrally grouped power, flap and trim adjustment, and is among the best of the American pattern. Both front seats slide right back for access and varying leg lengths, and, when forward, permit a reasonable sideways view through the moulded windscreen.

As we headed out into the crowded skies of East Anglia, on the first leg of the distance event, all four occupants were encouraged to carry on a neck-screwing commentary on local air activity, and I double-checked that our twin rotating beacons were switched on. With my seat slid back for comfort, and flying feet-off after carefully trimming out the rudder wheel, I looked at my cruise chart once more to verify the correct power settings.

Examination of the very detailed cruise tables in the pilot's manual of the 185 had shown that the best a.m.p.g. × block speed factor could obviously be achieved at altitude. Against this was the fact that it was necessary to come right down to deck level at each turning point for identification and also, as it happened, that strong headwinds were encountered on several of the cross-country legs. Figures were therefore extracted from the 2,500-ft. and 5,000-ft. cruise tables for the optimum A × Vb.

At the lower level, 21 in. Hg. and 2,200 r.p.m. (54% power) was said to give a T.A.S. of 140 m.p.h. at gross weight and, in normal lean mixture, a consumption of 10.2 U.S. gal./hr. (8.5 Imp. gal./hr.). Air miles per Imp. gal. would then be 16.5, the ultimate endurance 6.1 hours and the absolute range 850 st. miles. At the 5,000-ft. level, the same manifold pressure and 2,300 r.p.m. would give 60% power, a T.A.S. of 149 m.p.h., a consumption of 11.2 U.S. g.p.h. (9.35 Imp. g.p.h.), and an a.m.p. Imp. g. of just on 16. Range 820 miles and endurance 5.5 hr.

On these figures we could clearly go round the 600-odd-mile course non-stop, with well over an hour's fuel in reserve. It would obviously pay to do so, although refuelling stops for the single-engined aircraft were allowed at Rearsby and Shoreham. We would even qualify for the 60 bonus points awarded for each minute's fuel remaining (up to one hour) at the end of the course.

Fuel consumption is one of the critical points in a competition of this kind and the 185 has the advantage of having the Continental fuel-injection engine. Very positive control of manifold pressure, r.p.m. and fuel flow is ensured by the separate vernier/plungers for each and the corresponding gauges. The IO-470 has a big fuel flowmeter, calibrated in U.S. gal. per hour, with segmented settings between 15 and 21 for take-off power and climb, and the lower figures for the cruise power range. The higher figures are also marked with different altitudes for the achievement of maximum static power for take-off at airfields well above sea level.

All you have to do, after setting up boost and r.p.m. in the cruise, is to wind out the mixture knob until the needle falls back to the correct fuel-flow segment. Each percentage power segment has a high and a low edge, for either the best power or normal lean-mixture settings, or reference to the cruise chart will give the exact g.p.h. figure to set up on the dial. On the first leg, after selecting 21 in. Hg. and 2,200 r.p.m., I wound the mixture back to just over 10 g.p.h. on the flowmeter, and was gratified to see the airspeed settle down to around the promised 140-m.p.h. cruise.

In the air, I liked the handling of the Skywagon; it did not seem appreciably heavier on the controls than the smaller Cessnas, despite the increase in power and weight, and the longitudinal trim changes with power could be accurately and easily cancelled by the conveniently located tailplane and rudder bias wheels. The tailplane trimmer is necessarily, I suppose, low-geared, and its ratchet operation is rather stiff on occasions, but a flick of the finger will spin the rudder wheel round.

The advantages of high-wing stability became apparent as the morning air grew more lively, and the rear-seat passengers found it possible to doze after we had rounded the Seething turning point in a racing-style turn, and stayed down to what may loosely be described as "fairly low" to buck the freshening northerly headwind on track to Leicester. Course-keeping, feet off, proved quite simple, despite a drifting gyro which necessitated rather more attention to the meandering American bowl compass.

Low altitude brought with it a fuel-leaning problem. As a precaution against an excessively lean mixture I increased the fuel flow to about 11 U.S. g.p.h., although, with experience, it would probably have been quite safe to have reduced it to the higher altitude figure. From Rearsby, where several of the earlier contestants off could be seen refuelling, low-level map reading took on a new significance in the industrial tangle of the Midlands, but Wolverhampton Airport appeared on track after an anxious few minutes, and it was necessary to climb to about 2,000 ft. to clear the rising ground on the leg to Shobdon.

Winds were less adverse on this leg, which was too short, however, to make it worth while climbing any higher. Past Shobdon, on the long 148-st.-mile run to Shoreham, we went up to 4,000 ft., just below cloudbase, to take advantage of the following wind and better consumption conditions. At 21 in. Hg. and 2,300 r.p.m., airspeed increased slightly above 140 m.p.h. indicated for a fuel flow of less than 11 U.S. g.p.h., and our ground speed was a spanking 160 m.p.h.

To help with flight-planning we listened out to the half-hourly "actual" weather reports from London Airways on 126.7, but the excellent King VHF radio was not otherwise used. This relatively low-priced 90-channel crystal-controlled set is Class II equipment at the moment but, from the clarity and power of its operation, plus quality of construction, it might well be up-graded. Reception via the roof loudspeaker was excellent and the noise level of the Skywagon was sufficiently low for the optional headset to be discarded.

Halfway down the Shobdon-Shoreham leg the fuel gauges dropped below what appeared to be the half-full mark, and towards the red sector of their indeterminate calibration. With no experience of their accuracy, or, indeed, indications, we decided to put in at Shoreham for some precautionary fuel after checking with the officials that this was permissible without penalization. Our flight time to this point was just on 3 hr. 25 min. for the 462 st. miles, giving a satisfying block speed of around 135 m.p.h. Having started with full tanks, we filled one to capacity for the remaining legs and took on 17 Imp. gal.

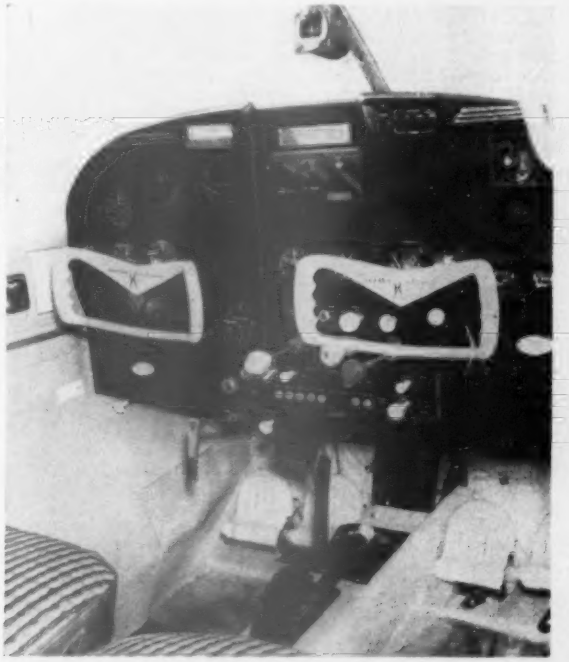
This meant we had used about 34 gal., or just on 10 Imp. gal./hr., giving an a.m.p.g. of 13.5. Consumption was therefore up and a.m.p.g. down on the book figures of around 9 and 16 because of the headwinds and low-altitude operation. The remaining legs were also flown at low altitude; at Beachy Head, we went close to the balcony of the lighthouse to ensure positive identification, and discovered why the keepers were not outside when we ran into the cobblestones of the north-westerly half-gale sweeping over from the Downs.

After rounding Rochester and Panshanger turning points, we landed back at Oxford 5¼ hours after take-off with a total flying time for the 625 miles of nearly 4 hr. 43 min. Final block speed was therefore about 132 m.p.h., and it took another 29 Imp. gal. to fill our tanks, bringing our overall consumption to 46 Imp. gal. Overall a.m.p.g. was 13.6 for an

All the single-engined Cessna range have exceptionally powerful slotted flaps, which give them very good short-field performances. Those on the Cessna 185 are seen here extended their full 40 degrees.

Aft extension of passenger accommodation into the baggage space of the smaller Cessnas makes the Skywagon a six-seater if required, although rear-seat access is restricted.

Photographs copyright "The Aeroplane and Astronautics"



In general, the Skywagon conforms to the usual Cessna cockpit layout, with plenty of room for instruments and equipment on the deep front panel. Points of interest include the press-button vernier plungers for throttle, pitch and mixture, and the ignition-key-operated starter.

hourly consumption of 9.7 Imp. gal. Although higher than the 8.5 Imp. gal./hr. book figure for the 2,500-ft. cruise, the consumption is undoubtedly very good for a 260-b.h.p. engine and a six-seater aeroplane at full load with such a block speed.

Having got rid of the ballast, both human and sand, after the distance event, I took off again with tanks refilled to try out the low-speed performance of the 185 before practising some short take-offs and landings. When taxi-ing the Skywagon, foot loads for the steerable tailwheel are fairly high and the reaction slightly spongy. With its tall fin, the 185 tends to weathercock fairly strongly into wind and, if too much rudder is applied to keep straight, the steering linkage disconnects with a bang and the aircraft swings round rapidly on the now-castoring tailwheel.

Since there is a briskish swing to port on opening up the Continental to full power for take-off, for which about half rudder travel is needed to keep straight, it would be useful, for some cross-wind operations, to have a tailwheel lock. I used 20 degrees, or the second notch, of the manually operated slotted flaps for take-off, the 185 not lending itself to the start-moving-dump-flap technique. When solo, with a forward C.G. and neutral trim, strong forward pressure on the wheel will raise the tail slightly before unstick, but with a full load, and the moment near the extreme aft C.G. at 143,414 lb. in., the 185 takes itself off in the three-point attitude at about 55 m.p.h. I.A.S. with a blip or two from the stall-warning horn.

There was no real opportunity to practise measured take-offs over a barrier before the competition, although I got a rough estimate of about 120 yd. in a 15-m.p.h. wind. Climb-away was vigorous at any load, being way above 1,500 ft./min. when solo at the best climb speed of around 90 m.p.h., and never below 1,000 ft./min. at max. gross.

To obtain a clean stall at a forward C.G. it was necessary to wind the tailplane trim wheel fully aft to counteract the nose-down tendency on throttling back. On hauling the wheel right back the warning horn began sounding at 65 m.p.h. I.A.S. and carried on blaring until a gentle breakaway followed at about 50 m.p.h. I.A.S. Snatching the wheel to *g*-stall the 185 at a very low airspeed gave a breakaway at 48 m.p.h., with a slight port-wing drop.

Thirty degrees of the powerful Cessna flaps are sufficient for most normal landings, but the fourth position, adding another 10 degrees, contributes a lot more drag if required. With 12 in. Hg. and 2,200 r.p.m. in this configuration, the airspeed goes right off the clock, which ends at 40 m.p.h., as a very exaggerated attitude is reached before the Skywagon quits flying and drops its starboard wing. True stalling speed, at full flap without power, is 60 m.p.h.

With full flap and aft trim, the addition of power at a forward C.G. does not result in much of a nose-up tendency, but there is rather a pronounced tailplane buffet—presumably from the downwash of the slipstream over the flaps. It is sufficient to cause several inches of control-wheel oscillation back and forth, and is a little disconcerting, although not dangerous. If the flaps are raised at full power without retrimming there is a very strong nose-up trim change which can just be held with one hand.

Because of the tailplane buffet with full flap, I found it difficult to perfect a satisfactory short-landing technique with the Skywagon, using any substantial amount of power to drag it in. Also, when solo, full aft trim was needed to ensure sufficient elevator being available to get the tail fully down for a bounce-free three-pointer on the springy steel landing gear and fat, low-pressure tyres. In the actual contest, I played it safe by bringing the 185 over the barrier with 30 degrees of flap and a little power, at 65 m.p.h., and then dumping full flap for the flare-out.

It was possible to use plenty of toe brake without raising the tail, but, given practice, I felt that I could have done a great deal better than the achieved 259 yd. from 10 ft. Although the book recommends a minimum approach speed of 75 m.p.h. with full flap, this seems quite high at lighter weights. Unfortunately, the graduation of the A.S.I. is not sufficiently large-scale at the low-speed end for really accurate figures to be determined. This would seem to be important for the marginal operations within the capability of the Skywagon.

The take-off contest presented quite a few problems. It was necessary to declare a figure to clear the 10-ft. tape first thing in the morning, on a forecast wind of 8-12 knots, and this would be one's starting point on the take-off grid. With no real experience to guide me, I consulted the flight manual of the 185 and found that the ground run, at 2,200 lb. all-up on a runway at sea level with a 15-m.p.h. wind and at 59° F., was given as 80 yd. We were operating from grass, although hard in surface, and weight, wind and temperature conditions were similar.

After agonizing thought, I came up with a figure of 135 yd. to clear 10 ft., aiming to be well on the safe side, to avoid losing all points by going through the barrier. While waiting for the start-up signal it was demoralizing to see a number of contestants taking the tape with them as they floundered off the ground—the wind speed having dropped instead of increased. I would dearly liked to have given myself a little more margin, but it was too late by then, and I had to stick to my original guesstimate.

The tape looked awfully close as I was marshalled into position 135 yd. from it. At full power the toe brakes held as I strained on them and I decided to keep the cowl flaps closed for the brief full-throttle period so as to remove every possible source of drag. As I dropped my heels to the floor I fed in plenty of right rudder to keep straight, leant well forward on the wheel to raise the tail and, after a brief pause to accelerate, heaved the 185 off the ground with a protesting bleat of stall-warning. I did not use an excessive amount of rotation, and had the satisfaction of seeing the tape flash by underneath out of the corner of my eye.

In all, the Skywagon did quite well in competition against most of the latest American business and touring types, and after about 10 hours on it I had grown attached to its versatility, performance and handling. It came fourth overall, and third in its class, and at a U.K.-delivered and duty-paid price of about £9,900 ($18,950 f.a.f. Wichita), including the King radio, was considerably cheaper than many of its less commodious competitors.

Leading Particulars

DIMENSIONS.—Span, 36 ft.; length, 26 ft. 2 in.; height, 7 ft. 6½ in.; wing area, 174 sq. ft.

WEIGHTS.—Empty, equipped, including pilot, 1,907 lb.; co-pilot, 180 lb.; fuel (51.6 Imp. gal.), 367 lb.; further disposable load, 826 lb.; max. gross, 3,200 lb.

PERFORMANCE.—Max. speed, 176 m.p.h.; max. cruise, 70% power at 8,000 ft., 165 m.p.h.; max. range cruise, 130 m.p.h. at 10,000 ft.; initial climb, 1,000 ft./min.; service ceiling, 17,300 ft.; take-off to 50 ft., 1,510 ft.; landing from 50 ft., 1,265 ft.; range at max. cruise, 770 miles; max. range, 885 miles.

Flying for TV

DURING the summer season of Grand Prix meetings Dunlop have organized a series of flights to get advertising films back from the track to the television studio—for showing by 10 o'clock the same evening. The films usually covered the race itself and an interview with the winning driver. As the shooting was never completed before six in the evening, and the average distance from the race tracks back to London was 200 miles, considerable co-ordination was necessary. The flights were ably organized, with a tightly packed schedule down to the last minute, and no time was lost in getting the film and commentator to the studio.

Le Mans, which is not, of course, a Grand Prix race, was also included in this series and was perhaps the easiest undertaking, with an airfield no more than 200 yards from the track. However, there were no Customs available at Le Mans this year and the extra landing involved at Deauville, for clearance purposes, looked as if it might defeat the schedule.

Accordingly, on the way out through Deauville, the urgency of the return flight next day was stressed to the Customs and control authorities. They co-operated magnificently. Priority approach was given and, to save seconds, Capt. Peter Nock, who was flying the Airwork Cessna 310, left the lowering of the undercarriage till one mile on final (and air traffic control were good enough to pass a polite reminder not to forget the wheels . . .).

On the ground at Deauville, Customs and Immigration officials were waiting on the ramp and paperwork was cleared with no one even getting out of the aircraft. Total time on the ground, including taxi-ing, was less than five minutes. On arrival at Gatwick the Cessna parked in the same bay as a B.E.A. helicopter and, with Customs clearance on the spot again, the helicopter was helped to get away to Teddington with the film and Mr. Kenneth Wolstenholme in no more than a matter of minutes.

For the Grand Prix races in Holland, France and Belgium the nearest airfields—of necessity Customs airfields—were all a number of miles from the race tracks. To avoid traffic jams, helicopters were chartered at this end. The film and commentator were picked up on the spot and flown to Schiphol, Rheims and Liège.

The schedule nearly went amok at Liège due to exceptionally poor visibility and low cloud at the time of departure from the track. With the helicopter half way to the airfield the weather deteriorated to near zero and for a time the aircraft was very unhappily hovering over a field in the valley, unable to climb to the cloud-covered field of Bierset, where the Cessna waited.

All in all, however, a pretty tight schedule was maintained. This was largely thanks to good liaison between the helicopters at each end and the Cessna which flew the main distance. It was also greatly helped by most praiseworthy co-operation from the various airfield authorities concerned.—S.F.

Controlling the VC 10

IN previous articles in this series (THE AEROPLANE AND ASTRONAUTICS for Nov. 18, 1960, and Feb. 10, 1961) we have dealt with certain major aspects of the design of the Vickers VC 10 second-generation turbojet transport, namely, its structural features and its "operational" characteristics. Here we shall describe the layout and design details of this important aircraft's flying control system.

It might, perhaps, be said at the outset that although the essential task required of the control system of a large modern aeroplane of this sort is basically a simple one, having much in common with that of less sophisticated aircraft, the means whereby this task has to be accomplished are by no means as easy to achieve. They are, for example, governed more stringently by consideration of the magnitude of the loads involved. This dictates some form of assistance for the pilot—with consequent complication and possible potential risks on the score of reliability. Safety, then, demands multiplication and further complexity. And the result is that the means devised to accomplish a fundamentally simple task have inevitably to comprise something very much more than a simple collection of levers and connecting mechanisms.

Thus, the complex which is described by the rather misleading term "control system" can itself be a major piece of engineering achievement that embraces ordinary mechanical problems as well as those involving hydraulics, electrics and electronics. In this, the VC 10 is no exception and the solution chosen by the Vickers-Armstrongs' team to overcome the important problems involved, and to satisfy the stringent requirements laid down, are worthy of the closest study.

A control system as complex as that of the VC 10—or of any other large turbojet aeroplane for that matter—is best "described" diagrammatically and this we have chosen to do with the four pages of drawings which accompany this article. As a supplement to these more graphic descriptions, however, it is worth while examining briefly the principal "philosophies" underlying the design team's solutions to the control problem and outlining some of the principal features of the system.

So far as the basic design aims are concerned, these have been summed up very clearly by the company's chief aerodynamicist, Mr. K. S. Lawson, B.Sc.(Eng.), D.L.C., A.F.R.Ae.S. He sets them out thus:—

"The keynote throughout the design has been safety. As well as covering all reasonable fault conditions in the design of the control system, we have attempted to provide good flying and control characteristics in normal operation because we feel strongly that such characteristics can make a major contribution to the safety of an aircraft. An aircraft which is easy and pleasant to fly reduces the work load on the pilot and, as a result, he is more likely to be able to cope with any emergency which might arise."

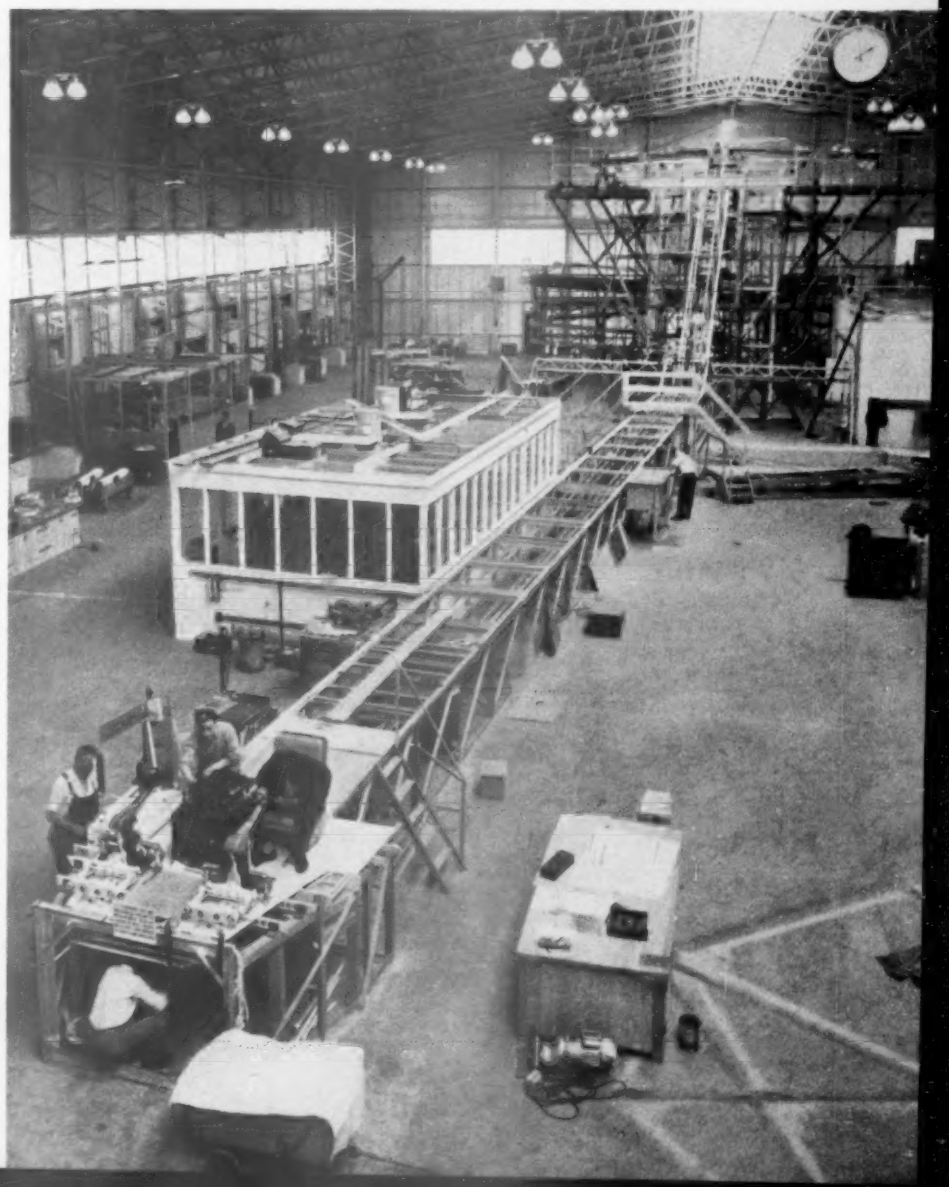
Good flying control characteristics are doubtless capable of definition in many ways. In the Vickers-Armstrongs' view, the contributory characteristics which go to make up these desirable qualities are sixfold.

First, the aircraft must be stable longitudinally and laterally under all conditions, preferably without any artificial stability augmentation. This, however, is qualified by the comment that on an aircraft like the VC 10 it is not possible with any practical configuration to obtain a satisfactory degree of lateral stability under all conditions without using some form of artificial stability, such as yaw damping. The aim has, therefore, been to make the aircraft flyable under the worst conditions without a yaw damper, but to accept the use of a yaw damper in order to obtain pleasant flying characteristics in such conditions.

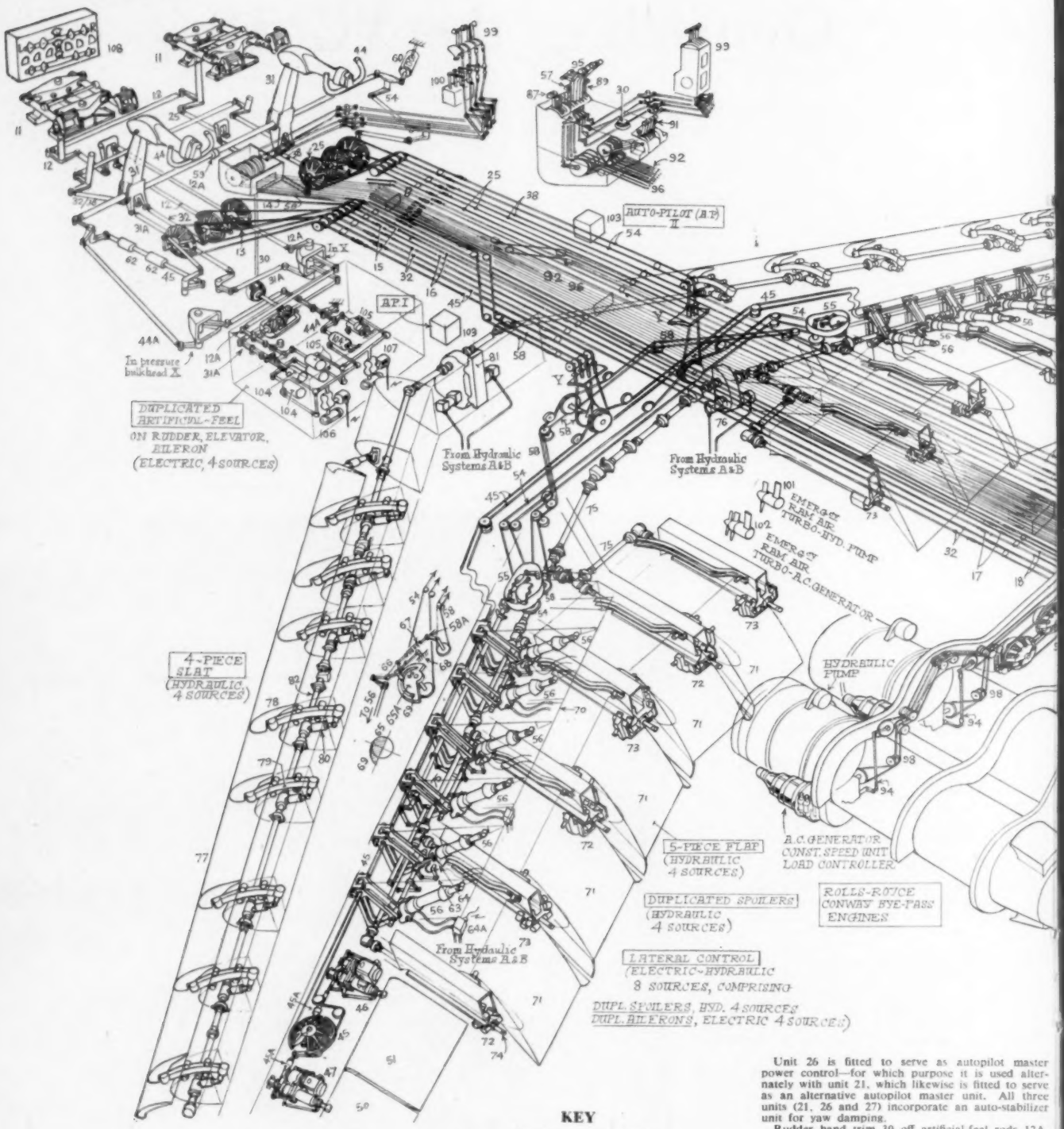
The second necessary characteristic is adequate control power under all flight conditions. Thirdly, the changes of trim arising from all normal configuration changes—such as flap, airbrake and undercarriage extension—must be kept to a minimum. Fourthly, the forces required to be exerted by the pilot at his handwheel and pedals to manœuvre the aircraft must not be so heavy that the manœuvrability is severely restricted; equally, of course, the pilot's control loads must not be so light as to make it possible easily to overstress the structure. The fifth necessary characteristic is that there should be no speed instability on the approach. And finally, under all cruising conditions the buffet boundary should be sufficiently high to provide adequate margins for normal manœuvres and gusts.

On the score of mechanical safety, a great deal of analysis has been done to establish possible fault conditions so that safety measures can be incorporated. These are indicated in the drawings. In general, the underlying principle has been to

(*Continued on page 186*)



The impressive extent of the VC 10 control system test rig/simulator at Weybridge is apparent in this general view. For details see the drawing on page 185.


AUTO-PILOT (A.P.) II
A.P.I
DUPLICATED ARTIFICIAL-FEEL ON RUDDER, ELEVATOR, AILERON (ELECTRIC, 4 SOURCES)
4-PIECE SLAT (HYDRAULIC, 4 SOURCES)
5-PIECE FLAP (HYDRAULIC 4 SOURCES)
DUPLICATED SPOILERS (HYDRAULIC 4 SOURCES)
LATERAL CONTROL (ELECTRIC-HYDRAULIC 8 SOURCES, COMPRISING DUPL. SPOILERS, HYD. 4 SOURCES DUPL. AILERONS, ELECTRIC 4 SOURCES)
From Hydraulic Systems A&B
From Hydraulic Systems A&B
In pressure bulkhead X
In X
EMERG'CY RAM AIR TURBO-HYD. PUMP
EMERG'CY RAM AIR TURBO-A.C. GENERATOR
HYDRAULIC PUMP
A.C. GENERATOR CONST. SPEED UNIT LOAD CONTROLLER
ROLLS-ROYCE CONWAY BYE-PASS ENGINES

Drawing by J. H. Clark, A.R.Ae.S.

© Temple Press Limited, 1961

KEY

(Numbers 1-10 not used)

FLYING CONTROLS

Rudder.—From dual pedals 11, rods 12, cable tensioner 13, cable 14, Yale-lock bolt 15 (ensuring that no two cables can be interchanged) and wires 16 solid-drawn for the entire straight run to draw-bolts 17.

Cables 18 to tensioner 19 with rods and spring strut 20 to switch-in electric unit 21 to move lower-rudder 24.

Electric unit comprises motor 21 driving pump 22 and self-contained hydraulic system to work jack 23 and move control surface.

From dual pedals 11 via duplicate alternative " fail-safe " run 25 to operate electric units 26 and 27 (for middle and upper rudders 28 and 29). Any unit and, therefore, control surface can be isolated from system by its own spring strut.

Unit 26 is fitted to serve as autopilot master power control—for which purpose it is used alternately with unit 21, which likewise is fitted to serve as an alternative autopilot master unit. All three units (21, 26 and 27) incorporate an auto-stabilizer unit for yaw damping.

Rudder hand trim 30 off artificial-feel rods 12A.

Elevators.—From dual sticks 31 via similar run 32 to rods 33, and electric units 34 and 35, to operate inner elevators 36 and 37. Also from sticks 31 via alternative " fail-safe " run 38 and rods 39 to electric units 40 and 41 to work outer-elevators 42 and 43 (units fitted with spring struts).

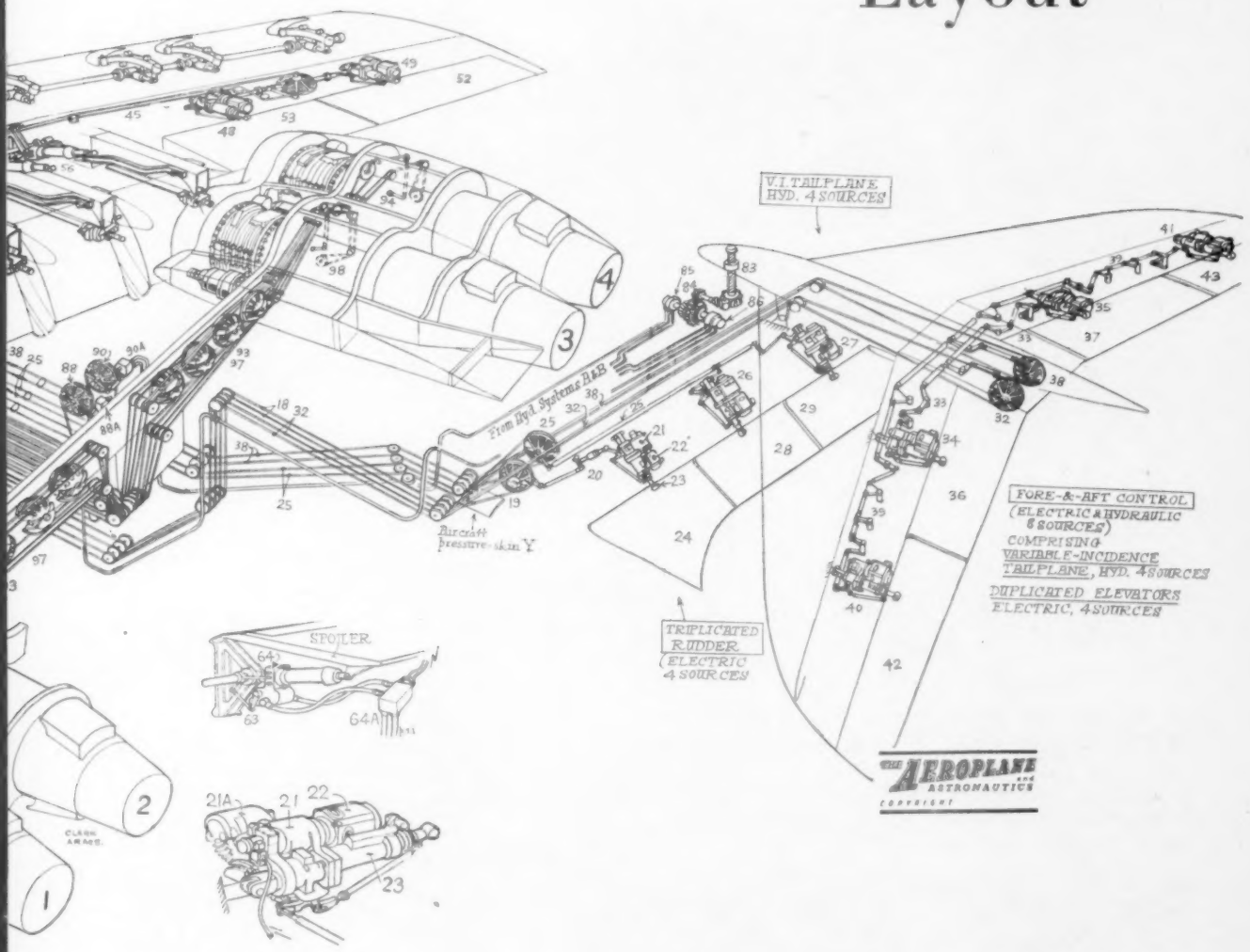
Unit 34 is fitted to serve as master autopilot unit, for which it is used alternately with unit 35 fitted likewise as an alternative autopilot master unit.

Artificial-feel feeds into stick via 31A.

Ailerons and Spoilers.—From stick-wheels 44 and runs 45 to electric units 46, 47, 48 and 49 working outer and inner ailerons 50, 51, 52 and 53. Isolating spring struts situated in rod work at 45A to protect each unit.

Unit 46 is fitted to serve as an autopilot master unit, and used as such alternately with unit 48, an alternative autopilot master unit.

VC 10 Flying Control System Layout


V.I. TAILPLANE, HYD. 4 SOURCES
FORE-&-AFT CONTROL (ELECTRIC & HYDRAULIC 6 SOURCES) COMPRISING VARIABLE-INCIDENCE TAILPLANE, HYD. 4 SOURCES
DUPLICATED ELEVATORS ELECTRIC, 4 SOURCES
TRIPLICATED RUDDER (ELECTRIC 4 SOURCES
From Hyd. Systems B&S
Aircraft pressure-skin
SPOILER
THE AEROPLANE and ASTRONAUTICS
COPYRIGHT

From dual stick-wheels 44 via runs 54 as spoiler control circuit to mixing boxes 55 thence to hydraulic jacks 56 to give differential spoiler action for lateral control.

From pilot's air-brake lever 57 on console and runs 58 to mixing boxes 55 thence to jacks 56 to give spoiler action in unison for air-brake and lift spill.

59. Manual-disconnect between sticks and systems.
60. Supplementary spring feel.
61. Not used. 44A. Rods feeding artificial-feel into both circuits.
62. Electrical aileron trimmer (duplicate).
63. Valve-operating linkage to jacks 56 and cut-off 64 feedback. Isolating spring strut fitted adjacent to 63 on each jack.
64A. Solenoid operates valve (if spoiler jams, press button, valve by-passed, jack collapses).
65A. Plate with track (quarter circle 65 plus cam 69) in which travels bell-crank 66 driven via spring strut 67 from 58.
68. Fixed point of radius-link holding bellcrank stationary on a radius and so:—

A. Lateral Control

With up-going aileron, 54 will rotate 65A and crank 66 moves outward in track 69 about fixed points 68 and 58A to operate 56 so that the spoiler goes up. On other wing, aileron going down, 54 rotates 65A oppositely and crank 66 travels in track 65; so there is no movement and spoiler inactive.

B. Air-brake

Control 57 on console operates cables 58 to move point 58A and rock 66 to operate spoilers on both sides, to act in unison as air-brakes and quite independent of lateral control.

C. Combined Lateral Control and Air-brake

(i) If, say, half air-brake is already on, and half lateral control 54 is applied; then spoiler goes full up with up-going aileron, and remains stationary on down-aileron wing.

(ii) If, say, full air-brake is already on and lateral control is applied, spoiler cannot go farther up with aileron so spring strut 67 collapses; the other spoiler will go down with down-going aileron.

70. Line of three-piece spoiler.

Flaps.—Five sections 71 on alternate design carriages 72 (inside rollers) and 73 (outside rollers). Carriages moved in and out by screw shaft 74 and shafting 75 from flap-actuating gearbox 76 driven by two hydraulic motors (off hydraulic systems A and B).

Slats.—Four-piece slat 77 with eight drive units as 78 (roller-tracked arms 79) moved by extending-screw-jack 80 worked by gearbox 81 (driven by two hydraulic motors—systems A and B) via shaft 82.

Variable-incidence Tail.—Screw jack 83 worked through differential drive 84 by hydraulic motor 85 off hydraulic system A or hydraulic motor 86 off system B.

Captain's controls 87 (selector and arming levers) and cable runs to tensioner 88 to operate valve 88A thence via pipes to tailjack motor 86.

Co-pilot's selector and arming controls 89. Cable runs to tensioner 90 to operate valve 90A thence via hydraulic lines to tailplane jack 85.

89A. Extension of 89 for captain to override co-pilot.

ENGINE CONTROLS

Console levers 91 and cable runs 92 to tensioners 93; thence via cables and steel rods 94 (indestructible in event of nacelle fire) to steel H.P. cocks.

Console levers 95 (with reverse-thrust links 95A, outboard engines only on VC 10, all four on Super VC 10) to cable runs 96 to tensioners 97; thence via cables 98 to throttles.

99. Engineer's throttle controls.

100. Automatic throttle-trim used on the approach and auto-flare.

101 and 102. Emergency ram air turbines drive hydraulic pump and AC generator to supply systems (swing down into airstream from underbelly), levers 101A, 102A on console.

103. Autopilots (either one in use, the other standby). They control units 21/26, 34/35, 46/48.

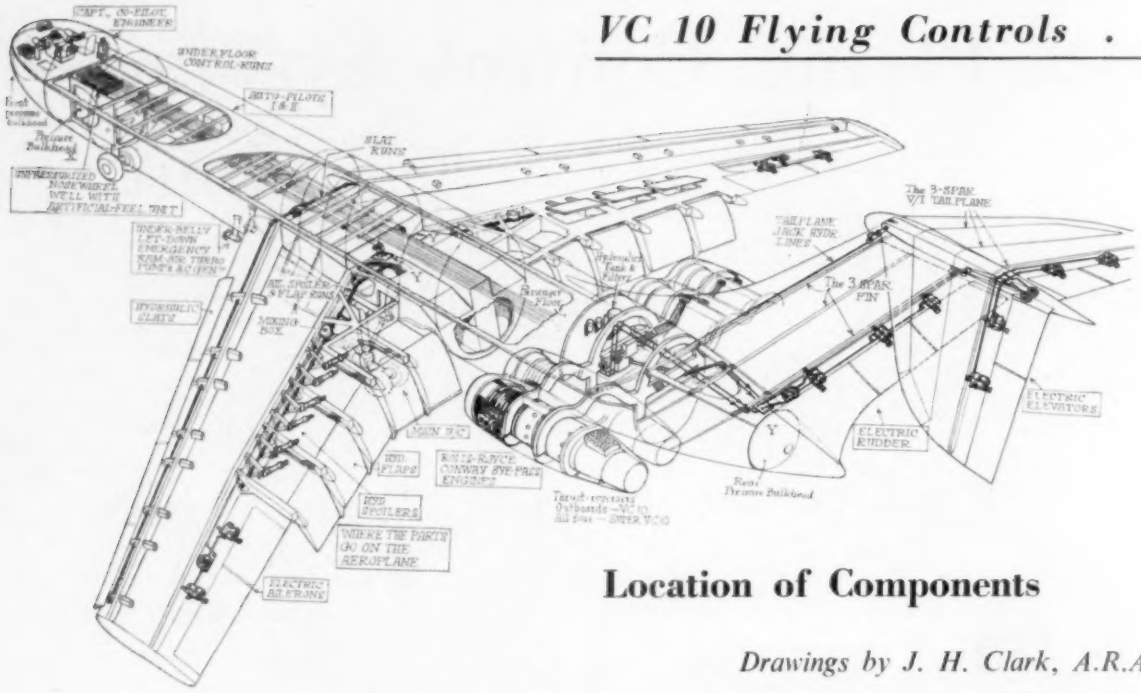
Artificial-feel.—104. Operating jacks (hydraulic) and their duplicates 105.

106. Hydraulic pump (with its accumulator) for 104, 104, 104 driven by electric motor running off electric supply system A.

107. Another for 105, 105, 105 off electric supply system B.

Control-surfaces Indicator.—108. Aeroplane outline with visual clinometer for each section of rudder, elevators, spoilers and ailerons.

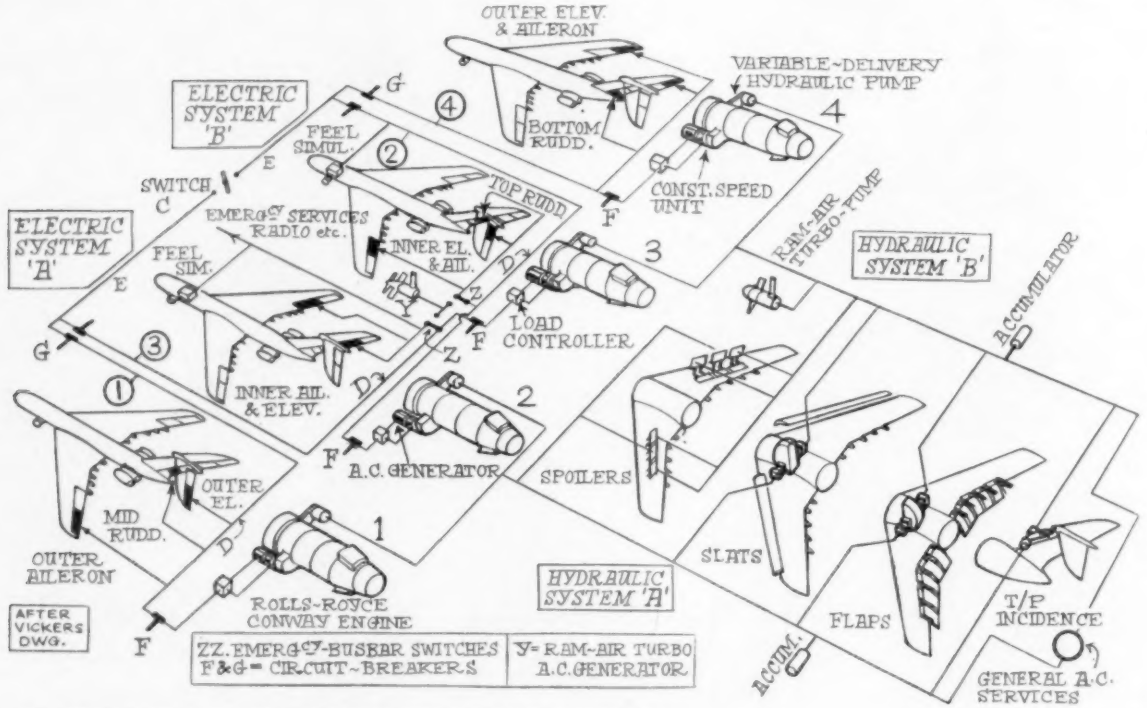
VC 10 Flying Controls . . . .

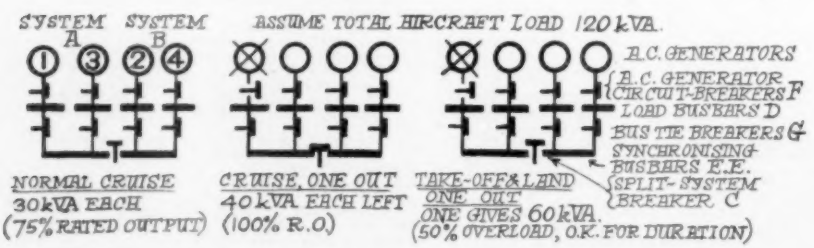


Location of Components

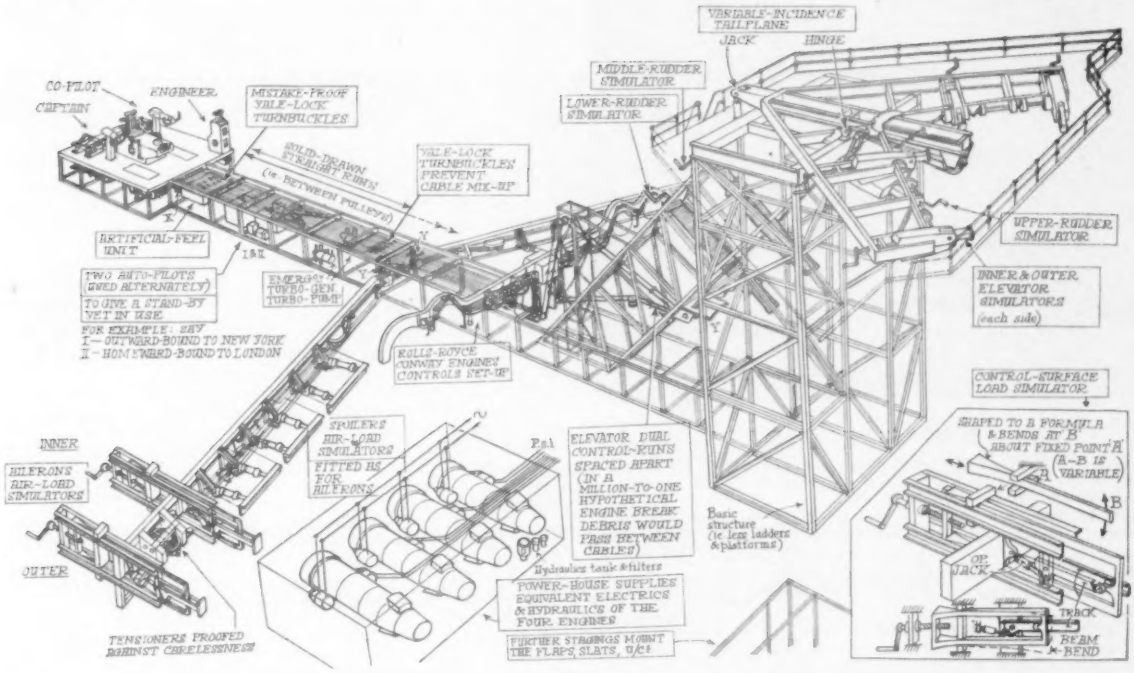
Drawings by J. H. Clark, A.R.Ae.S.

© Temple Press Limited, 1961.

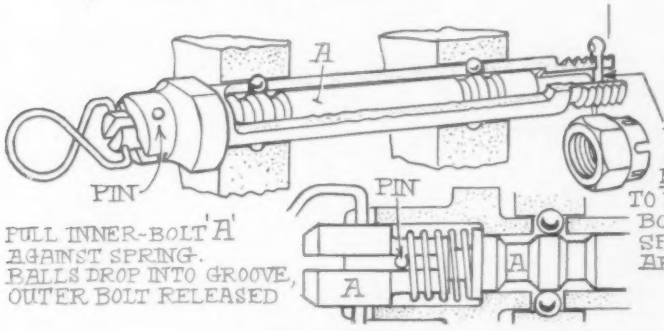


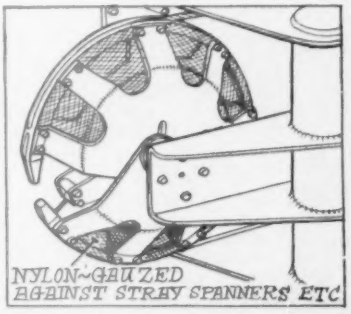


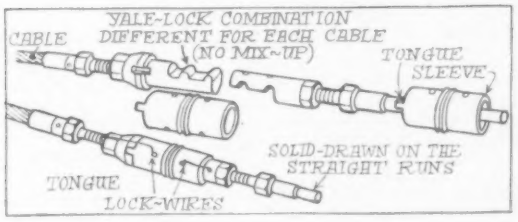
Power Circuiting


VARIABLE-INCIDENCE TAILPLANE
JACK
HINGE
MIDDLE-RUDDER SIMULATOR
LOWER-RUDDER SIMULATOR
CO-PILOT
ENGINEER
CAPTAIN
MISTAKE-PROOF YALE-LOCK TURNBUCKLES
SOLID-DRAWN STRAIGHT RUNS (ie. BETWEEN PULLEYS)
YALE-LOCK TURNBUCKLES PREVENT CABLE MIX-UP
UPPER-RUDDER SIMULATOR
ARTIFICIAL-FEEL UNIT
TWO AUTO-PILOTS (USED ALTERNATELY) TO GIVE A STAND-BY YET IN USE
FOR EXAMPLE: DAY I — OUTWARD-BOUND TO NEW YORK II — HOMEWARD-BOUND TO LONDON
EMERGENCY TURBO-GEN TURBO-PUMP
INNER & OUTER ELEVATOR SIMULATORS (each side)
ROLLS-ROYCE CONWAY ENGINES CONTROLS SET-UP
CONTROL-SURFACE LOAD SIMULATOR
SHAPED TO A FORMULA & BENDS AT 'B' ABOUT FIXED POINT 'A' (A–B IS VARIABLE)
INNER
AILERONS AIR-LOAD SIMULATORS
SPOILERS AIR-LOAD SIMULATORS FITTED AS FOR AILERONS
ELEVATOR DUAL CONTROL-RUNS SPACED APART (IN A MILLION-TO-ONE HYPOTHETICAL ENGINE BREAK DEBRIS WOULD PASS BETWEEN CABLES)
Basic structure (ie less ladders & platforms)
OUTER
Hydraulics tank & filters
POWER-HOUSE SUPPLIES EQUIVALENT ELECTRICS & HYDRAULICS OF THE FOUR ENGINES
FURTHER STRAINGS MOUNT THE FLAPS, SLATS, etc.
TENSIONERS PROOFED AGAINST CARELESSNESS
JACK
TRACK
BEAM
BEND

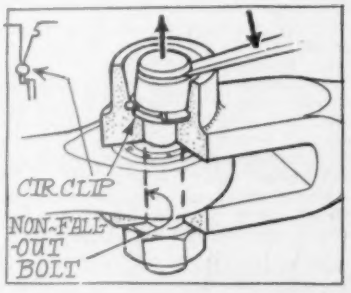
Systems Simulator

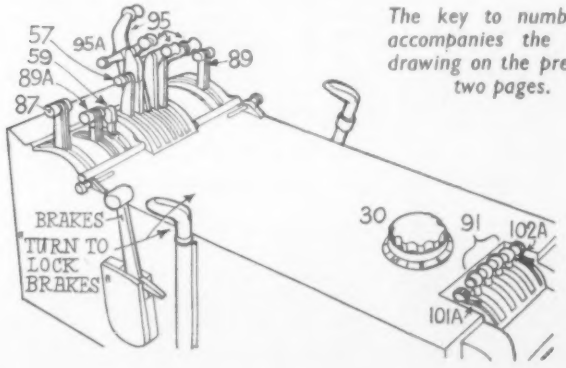

A
PIN
PULL INNER-BOLT 'A' AGAINST SPRING. BALLS DROP INTO GROOVE, OUTER BOLT RELEASED
PIN
A
A
YOU CANNOT PUSH PIN IN TO RELEASE BOLT IF NUT & SPLIT PIN ARE ON



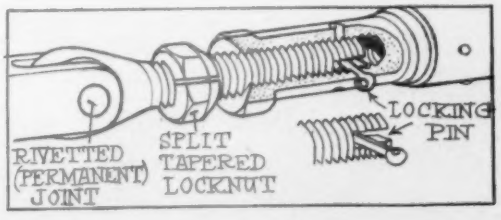


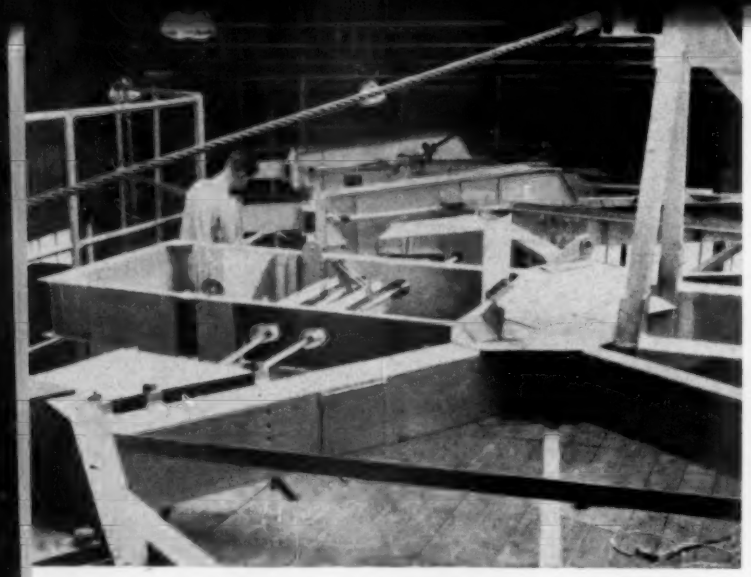
Details of Safety Devices





The key to numbering accompanies the main drawing on the previous two pages.





A view of the tailplane part of the control-system test rig from the top of the structure showing the elevator operating devices.

(*Continued from page 181*)

design the system so that at least two failures in any part of the control system during a flight can be tolerated without endangering the aircraft.

In selecting the overall type of system best suited to meet these requirements, an assessment was made of the relative merits of having a fully powered system, a completely manual one, or some combination of both. These studies showed that on the credit side of power operation were the following points:—

Control surface mass-balance (amounting to about 1,000 lb. on the VC 10) is not required, provided that the circuits have sufficient stiffness; this can be achieved by mounting the jacks of the power control units adjacent to the control surfaces.

Smaller and lighter controls can be used because: (a) without aerodynamic balances they can be moved through larger angles; (b) provided that there is sufficient power available, non-linearity of the hinge moment characteristics at the larger angles are not important; and (c) balance tabs moving in opposite direction to the control are not required.

The stiff control circuits and absence of tabs considerably reduce the flutter hazard.

Aircraft stability is the same when the pilot's controls are free as when they are fixed; with manually operated controls there can be substantial losses of stability on freeing the pilot's controls unless the surfaces have large amounts of aerodynamic balance.

With complete power operation the pilot's control feel is provided entirely artificially, and the feel characteristics can be arranged to be pleasant and satisfactory over the whole range of flight conditions.

Flight development time can be substantially reduced because a great deal of control system development can be done on ground rigs before the first flight.

On the debit side of the power-control account, it was considered that: (a) multiplication of components would be essential to obtain the high standard of control system integrity required; (b) more maintenance would be required than with a manual system; and (c) the first cost and cost of spares would be greater for a power-operated system.

Consideration of all the factors led to the rejection of a mixed system of power and manual operation on the grounds that, to a large extent, it combines the disadvantages of each separate system. It was also considered that the reliability of the power system is adversely affected by the manual reversion mechanism.

The final choice was, then, a completely power-operated system. And in order to achieve the very high standard of integrity specified, a triplicated system was decided on, even though the airworthiness requirements do not call for more than duplication.

As shown in the accompanying drawings, this has been accomplished by splitting the control surfaces and having independent and relatively simple power control units operating each portion. The rudder is split into three portions and the elevators and ailerons into two per side (or four altogether for each).

This makes a total of 11 control surfaces, to which the power control units are connected directly. Each of these units is a package comprising an electric motor, a hydraulic pump, a hydraulic jack and a differential linkage. These components are identical in each of the 11 units; where necessary, however, additional components are fitted to these basic units to cater for autopilot and yaw-damper requirements.

The control system was conceived from the outset as an integrated system—that is to say, it embodies complete integration of the power control units and autopilots. In addition to all the normal autopilot facilities, an automatic flare-out mode is also provided, and the system has been designed so that it can be developed to provide eventually for completely automatic landing.

For the system as a whole, the design is such that any of the control surface portions can "run away" to the maximum possible extent—i.e., to full movement or to the position corresponding to the maximum jack effort, whichever is the lesser—without endangering the aircraft, either on the score of controllability or stressing. Should such a power unit failure occur, switching off the electric motor will ensure that the hydraulic pressure in the circuit will decrease; and when this reaches a given preset value, a mechanical lock is released and the control surface portion will move slowly into a near-neutral lock.

Duplication and Segregation

The control circuits in the fuselage are duplicated and designed so that if any element in either of the duplicated circuits fails there will be no loss of overall control. Means are also incorporated to prevent a failure of any power control unit in a control channel from interfering with the operation of the other units in the same channel.

Power for all 11 control units comes from the aircraft's electrical system. In the extremely remote event of the "loss" of all four engines, an emergency electrical power supply is available from a ram-air turbine.

As a further safeguard, however, an alternative means of control is available from the aircraft's hydraulic system, which powers the spoilers—in six portions—and the trimming tailplane. Normally, the spoilers provide about half the total rolling power, so in the unlikely case of complete loss of aileron power there is adequate power available from the spoilers for rolling control. The tailplane movement is normally used only for trimming purposes, but this, too, can be used in an emergency for pitch control in the equally unlikely event of a complete loss of normal elevator power.

There are two hydraulic jacks and associated linkages operating each portion of the spoiler. The jacks on the inboard and outboard spoilers are supplied from one half of the hydraulic system and the jacks on the central portions are supplied from the other half.

In all the control channels there is a duplicated artificial-feel system for the pilot's controls. Each half of the system comprises an electric motor, a hydraulic pump and reservoir, three control units and three jacks. The function of the control units is to regulate the hydraulic pressure as a function of indicated airspeed, and also of altitude in the case of the elevator and aileron units.

A detail of a power control unit for "elevator" operation in the rig.

BRITISH UNITED AIRWAYS CHOOSES

THE SHORT HAUL JET

BAC ONE-ELEVEN

TWO ROLLS-ROYCE SPEY TURBOFAN ENGINES

JET SUCCESSOR TO THE VISCOUNT
WITH EVEN BETTER THAN VISCOUNT ECONOMICS

- 540 m.p.h. cruise speed
- 57 mixed class or 69 tourist passengers
- Short airfield performance
- Quick turn-round: built-in auxiliary power unit
- Cabin width for spacious five-abreast seating
- Range of over 1,100 miles with full 14,000 lb payload

BRITISH AIRCRAFT CORPORATION

ONE HUNDRED PALL MALL LONDON SW1 ENGLAND

TGA 8451Q

VICKERS **VIGILANT** the finest, most

VICKERS-ARMSTRONGS (AIRCRAFT) LTD WEYBRIDGE SURREY A Company of

BRITISH AIRCRAFT

ONE HUNDRED PALL MALL LONDON SW1

AND NOW–
VIGILANT SCORES AGAIN

On July 7th at Warminster, a large audience of Nato Military observers and press correspondents saw Vigilant:

- **Score 12 hits in 13 shots**
- **Successfully engage moving tanks at ranges out to 1350 yards**
- **Hit 4 oncoming tanks in 48 seconds, the attack being spread over a 40 degree arc**

On May 12th 'somewhere in Europe' other Military observers saw Vigilant:

Score 11 hits out of 13 shots

Hit 'crossing' tanks moving at 25 mph

Hit a tank at less than 200 yards

Hit tanks making snap appearances of 15 seconds and 20 seconds

lethal and most accurate one-man anti-tank missile in the world

CORPORATION

BVW.3

VC10 & SUPER VC10

The Clean Wing shape of the future

...and built by

BRITISH AIRCRAFT CORPORATION

ONE HUNDRED PALL MALL LONDON SW1 ENGLAND

TGA BVC30

Testing a "Segmented Solid"

THE prototype of a booster-size, segmented, solid-propellent rocket engine was successfully static-fired by the United Technology Corporation on Aug. 5. The test, conducted for the National Aeronautics and Space Administration, was carried out at U.T.C.'s Development Center near Morgan Hill, California.

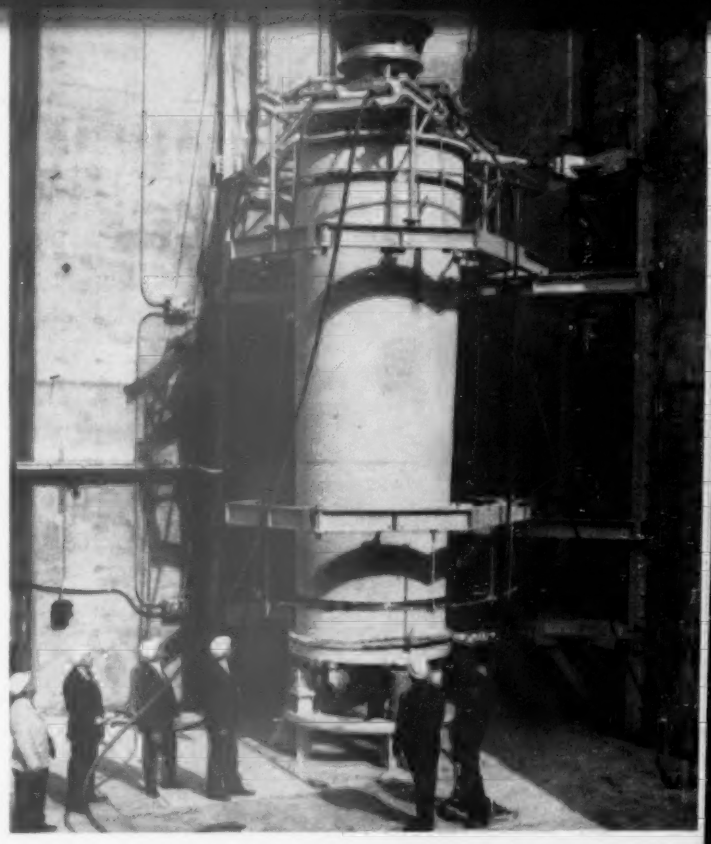
Fired in a nozzle-up position, the huge conical rocket engine, 26.5 ft. long and 7.5 ft. in diameter at its widest section, developed a thrust of approximately 250,000 lb. for 80 seconds. Its exhaust flame shot high into the air above the reinforced-concrete vertical test bay which has been specially constructed for solid rocket engine testing. The 80-second burning period fulfills the minimum requirements for an efficient and practical space booster. Shorter burning times, the company emphasizes, would impose excessive *g* loading on both mechanical and human payloads.

Whereas only relatively heavy-walled test casings, unsuitable for flight operation, have been used in earlier test work, the segmented booster fired on this occasion employed a lightweight steel casing of exact flight design. This was fabricated by Pratt & Whitney Aircraft, a division of United Aircraft, in East Hartford, Connecticut. The solid propellent was developed by the Research Division of United Technology Corporation. The firing also marked the first occasion on which a full-scale test had been made of a prototype propellent charge of the thickness required for large booster engines.

It is U.T.C.'s claim that the major obstacles to the production of single rockets of up to three million pounds thrust have now been successfully overcome. By clustering such motors, they say, thrusts as high as 25 million pounds can be produced.

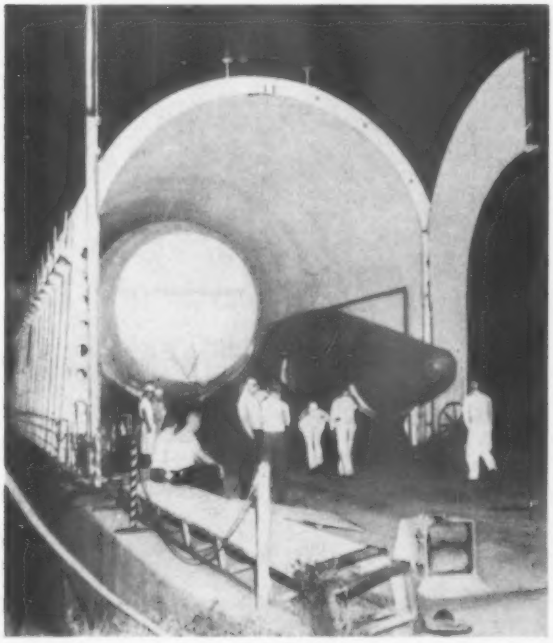
The centre section of the three-segment U.T.C. engine contained almost 30 tons of solid propellent, more than any single rocket segment ever built in the United States. By comparison, the first stage of a Minuteman rocket holds 22 tons. In all, the three segments of the U.T.C. engine contained nearly 40 tons of propellent.

Assembly of the rocket engine under field conditions took place without a hitch. The joint which secures the segments together is of the clevis type, utilizing shear pins which are slipped into place by hand. As a crane lowered one segment after another, they were fitted together and secured in less than 15 minutes.



Close-up of the U.T.C. segmented rocket engine in the test cell prior to the successful static firing on Aug. 5. It developed a thrust of some 250,000 lb. for 80 seconds.

Although the present segmented rocket engine was financed through corporate resources, NASA paid the cost of the test firing as part of the agency's study programme into high-thrust booster development. By the end of the year, United Technology Corporation expects to test a rocket engine of similar design but with double the thrust—half a million pounds.



The first flight-weight Saturn booster begins its long journey from the Marshall Space Flight Center in Huntsville to Cape Canaveral aboard the barge "Palaemon." Because a lock has broken at the Wheeler Dam, it was transferred to another barge at this point for transport down the Tennessee and Mississipi Rivers to the Gulf of Mexico—and the Cape.

Space Experiments by Balloon

THE Air Ministry Meteorological Office and the R.A.F. are to assist scientists of Bristol University in experiments into the relationship between solar modulation and cosmic particles entering the solar system.

The experiments, intended to discover more of what goes on in interplanetary space, are being conducted by a team from the H. H. Wills Physics Laboratory of the University, under Dr. C. J. Waddington. Already the team have sent up balloons, carrying stacks of photographic emulsion, from the new Air Ministry Meteorological Station at Shanwell, Fife, and from R.A.F., Cardington.

Unlike ordinary meteorological balloons those carrying the emulsion stacks have special valves which, by releasing excess gas, enable them to drift at a chosen height, usually about 115,000 ft. Normal balloons go on rising until they burst. The balloons are tracked by radar and at a pre-determined time the loads are dropped on parachutes.

Electrically charged cosmic particles originating from outside the solar system come into conflict with solar magnetic fields as they approach the earth, and some at least of them are deflected. Some of those particles that reach the upper atmosphere pass through the photographic emulsion—which is similar to the emulsion on an ordinary film but much thicker—and when the emulsion is developed, rows of silver grains give a "picture" illustrating the behaviour of the particles. The effect of their entry into the solar system is rather like that of a stick thrown into a bramble bush: only those coming from a "lucky" direction, or thrown very hard, get through, explains Dr. Waddington.

Although the experiments do not have any direct bearing on future space travel, the information obtained supplements that gained from space probes and satellites, and increases knowledge of interplanetary space. Meteorological officers have provided suitable locations for launching and tracking of the balloons by radar.

The Triumph of Major Titov

VOSTOK II was launched from the "cosmodrome" at Baykonur—some 200 miles north-east of the Aral Sea in Southern Siberia. This "flight," on Aug. 6-7, follows six earlier ones—not all of them successful—beginning in May, 1960, when a dummy astronaut was sent into orbit. Subsequently, orbital flights were made with dogs until, on Apr. 12 this year, the historic single-orbit mission was accomplished by Major Yuri Gagarin. A full description of the development programme appeared in THE AEROPLANE AND ASTRONAUTICS of Apr. 20, 1961, pp. 435-438.

The orbit of Vostok II was inclined at 64° 56′ to the Equator, and initial tracking information showed that the vehicle was moving in a near-circular orbit with a perigee of 110.6 miles and an apogee of 159.7 miles. The initial orbital period was 88.6 minutes.

Tass gave these details of the "cosmonaut," Major Gherman Stepanovich Titov: Born in 1935 in the village of Verkhneye Zhilino, in the Altai region of Siberia, he studied at a local secondary school. From 1955 to 1957 he attended the Stalingrad Air Force Flying School where he obtained first-class results and an excellent pass in the pilot's examination. After leaving the flying school, he served with the Air Force in the Leningrad Military District. Major Titov is married but has no children.

Major Gherman Stepanovich Titov.

At the "Cosmodrome"

The launching was described by a special *Tass* correspondent. He wrote:—

"The sun, burning hot over the steppe, lit up the silver coloured spaceship, the cosmodrome and the flowers growing beside the pavement. Members of the Government commission, distinguished Soviet scientists, designers, engine testing personnel and the staff of the launching command assembled at the command post.

"Here comes the light-blue bus carrying the spaceman. Titov alights, crosses to the launching area, and the lift takes him up to the cabin. He is wearing an orange-coloured flying suit with 'U.S.S.R.' printed on it. Under the suit are various instruments which will send back information about the pilot's physical condition.

"To observe the spaceship take-off we go to a special square about a mile from the launching place, but we are not cut off from what is happening on the spaceship; the radio brings the final commands.

"At last in the silence rings out the command 'Take-off.' From a distance we can see the rocket already completely free from the supporting gantry. Another second—exactly 9 a.m.—and the rocket, slowly, it seems very slowly, leaves the Earth.

"Gathering speed it ascends more and more quickly upwards; then at a comparatively low altitude the rocket begins to turn and flies on its set course into orbit."

During his long stay in orbit Major Titov reported regularly to Earth on a two-way communications link while Russian scientists kept him under observation on television. Radio telemetry also gave ground stations a continuous account of the astronaut's physiological reactions and the operation of the spacecraft's various systems. A tape-recorder was included in the cabin for recording the speech of the astronaut, providing also for "automatic accelerated readings of recordings on command from Earth."

This map shows the relative positions of the launching site at Baykonur and the landing area in the Saratov district. The disposition of the sites—nearly 1,000 miles apart—takes into account the Earth's west-east rotation, providing for recovery after one or 17-18 orbits for Vostok I and II respectively.

After Major Titov had been in orbit for some time, continuously reporting back his observations to ground receiving stations, he rested during the first hour of the fourth orbit and then performed certain physical exercises. At 2.31 p.m. (B.S.T.), the astronaut reported that he was "feeling fine, with everything in order"; and at 2.37 he transmitted the readings of various flight instruments. At 2.48 p.m. he gave the information: "Cabin pressure constant, humidity 70%, temperature 68° F.; feeling completely comfortable."

During the first 8½ hours, Vostok II covered 148,130 miles and completed the sixth revolution at 3.42 p.m.

Moscow Radio added that television pictures transmitted to Earth showed "the calm and smiling face of the Soviet cosmonaut." Extensive scientific data, it was reported, as well as detailed data about the functioning of systems in the spacecraft, were being received on the multi-channel telemetry equipment.

Manual Orientation Tests

After lunching on paste-like foods, Titov did more exercises and continued his work schedule. He continued to report on the functioning of the equipment. Then, for an hour, he tested the spacecraft's manual controls. This presumably involved orientating the vehicle about its major axes (in pitch, yaw and roll) in conjunction with the "optic orientator" fitted to one of the viewing ports, which provides a visual indication of the horizon (THE AEROPLANE AND ASTRONAUTICS, May 4, 1961, p. 480).

A good will message from Major Gagarin was received in Vostok II during the flight. Titov confirmed that he had received it and expressed his thanks.

Meanwhile, monitoring of the spacecraft's equipment was continued by ground control. "The astronaut continues in excellent condition," Moscow Radio reported. "His ability to work has been fully preserved under weightless conditions. No deviations have been noted in the functioning of his cardiovascular system or his breathing. His pulse-rate is 80-100 per minute and respiration 20-28 per minute. The electrocardiograms practically do not differ from those initially recorded on the ground. According to the telemetered data, the entire equipment ensuring the biological functions of the astronaut is working normally.

"Air temperature in the cabin fluctuates between 68° F. and 71.6° F., pressure 750-760 mm., relative humidity 70%, oxygen content in the cabin is about 24.15% and carbon dioxide 0.4%."

By 4 p.m. (B.S.T.), Major Titov was in his seventh orbit. Moscow Radio reported: "The astronaut again operated manual controls and the ship obeyed the movements of the pilot's stick." Then it was announced that "in accordance with the flight programme, the astronaut is to rest and sleep between 4.30 p.m. and midnight (B.S.T.). Consequently, the two-way radio contact with him has been temporarily suspended. Radio telemetric control of the functioning of the equipment in the spaceship satellite and the equipment ensuring the biological functions and the general state of the astronaut, is continuing. According to the latest telemetered data, the

astronaut's pulse rate during sleep is normal at 58 per minute."

Moscow Radio announced that by 4 a.m. (B.S.T.) on Aug. 7 Vostok II had completed 15 orbits. It also stated for the first time that "there were living organisms aboard" besides the astronaut. During rest periods, Major Titov was given the opportunity to use a wide-band receiver for reception of transmissions on medium/short waves. At one stage he reported that he was listening to Siberian songs.

He also said that he was observing the Earth from three portholes in the spacecraft. At the end of his 16th orbit, the Vostok had travelled 406,630 miles. The astronaut's condition was again described as excellent. His co-ordination and working ability had been fully preserved under weightlessness, and he had enjoyed his breakfast. Conditions inside the spacecraft were reported to be normal and radio communication with Major Titov reliable.

Approaching the time when the predetermined landing area in the U.S.S.R. would once again be synchronized with the orbit of Vostok II, the retro-rocket was fired to start the vehicle on its long descent trajectory. This took it over the continent of Africa to a landing in the Saratov region of the U.S.S.R., some 450 miles south-east of Moscow. Just before 10 a.m. on Aug. 7 Moscow Radio broadcast this statement: "This is Radio Moscow. This is Radio Moscow. The flight of the Soviet astronaut Gherman Titov on board the spaceship Vostok II has ended safely. After orbiting the Earth more than 17 times in the course of 25 hr. 18 min., and covering over 435,000 miles, Major Titov landed in a predetermined region of the Soviet Union not far from the place where Major Gagarin in the spaceship Vostok I landed on Apr. 12, 1961. The scientific programme has been completed successfully according to plan."

Weightlessness No Obstacle

After his return, Major Titov told a *Pravda* correspondent that twice during the flight he had seen the Moon, "which looks about the same as it does from Earth." The stars seemed brighter, however, and the Sun was so bright that it was impossible to look at it. (*Pravda* said that when the astronaut landed, he had a red face "as though he had space sunburn.")

"All that I saw and felt during the spaceflight," Major Titov said, "accords in full with the impressions of my friend Yuri Gagarin. Our main impression is that weightlessness is no obstacle either to life or to work."

During the flight, he went on, he had listened to many of the World's radio stations. He had, for instance, heard the *Tass* report on his flight made by a broadcasting station in Russia. He had eaten three meals and slept (wakefully) for 7½ hours.

Major Titov Meets the Press

Despite the assurance from some quarters that the Russians are being more forthcoming about their space activities, the two-hour Press Conference held for Major Titov at Moscow University on Aug. 11 produced little new technical information.

Outlining the progress of the flight, Major Titov stated that from the moment of take-off he experienced no ill effects from acceleration, noise and vibration. Once in space, his cabin was flooded with sunlight and he could see the bright sunlit surface of the Earth and at the same time the stars "as clear and bright points on a black background." Both his instruments and information transmitted from the ground confirmed that he was in the predetermined orbit.

At 10 a.m. Moscow time—an hour after lift-off—he switched on the manual controls for the first time. The next time he did so he was on his seventh orbit.

The major said he saw rivers, mountains, fields, both cultivated and fallow, harvested and unharvested. He could tell clouds from snow by the fact that clouds cast shadows on the Earth's surface.

At one stage, when he observed the Earth through a porthole, it appeared to be hanging over his head and he "could not help wondering what was keeping it there."

He said normal climatic conditions (pressure of one atmosphere) were maintained in the spaceship cabin. "I did not have a very good appetite," he went on, "but this was evidently due to the strange weightless condition—and to a certain condition of excitement." He said he did not sleep during the whole time allotted in the flight programme. "Sometimes I woke up, but then I got used to it and even slept 25 minutes longer than I should have done." He took no tablets. He did not dream during the flight, nor had he dreamed since returning to Earth.

Asked how he consumed his food, Major Titov said he ate specially prepared "space food" which he obtained from "toothpaste" tubes: "you press the tube and swallow the food, a very simple operation." Did he open his space helmet often? The astronaut replied that the question was better put the other way round. He practically did not shut it at all. (Pictures of Major Gagarin show that the helmet has a transparent visor with (apparently) inflatable tubes to seal it around the edges when closed.)

Of the weightless condition, a Soviet scientist said there were no ill effects and the astronaut was able to work and rest normally. However, Major Titov found that moving his head quickly under weightlessness produced "an unpleasant sensation"; this rapidly disappeared when he remained still. It was clear, therefore, that weightlessness would require further investigation on this account.

The transition from weightlessness, Major Titov stated, involved no abrupt changes, and after landing neither he nor the medical experts could detect any changes in his physiological condition. During re-entry he "did not close the portholes, but watched the bright luminescence of the air, which changed in colour with the speed and altitude of the spaceship." The disposition of these portholes in the spacecraft has not so far been disclosed.

Of the landing itself, he said: "The descent of the spaceship and its landing system provides for the use of two methods—either for landing inside the cabin of the spaceship or for ejection of the pilot's seat from the spaceship and descent by parachute.

"I had permission to use either of these two systems. My condition was excellent and I decided to test the second landing system. At low altitude my seat ejected. The spaceship landed safely nearby." This technique was, in fact, tested in the second Soviet satellite-spaceship which carried the two dogs Strelka and Belka. On that occasion the capsule was said to have separated from the spacecraft after it had descended to a height between 23,000 and 26,000 ft. It landed at a speed of 20-26 ft./sec., while the spaceship itself touched down at nearly 33 ft./sec. In the case of Major Gagarin's flight the landing was made within the cabin.

When asked if any pictures of the Earth had been taken during the flight, Major Titov surprised everyone by saying that he had taken with him "an ordinary little camera of the kind used by Pressmen" and that with this he "took a few snapshots in outer space. The film is now being processed," he continued, "and to tell you the truth, I am not at all certain of the results."

A questioner asked if two men could have flown in Vostok II. Major Titov replied: "In principle, yes. But in practice it was fitted for one person."

Filling in other aspects of the mission, Prof. V. Yezdovski said that Soviet physicists had timed the flight to coincide with a period of low radiation activity, after making probings of the stratosphere.

Asked if foreign correspondents would be able to witness the launching of future Soviet spaceships, Prof. M. V. Keldysh, the new President of the Soviet Academy of Sciences, replied: "Yes, they undoubtedly will be and we are doing everything to bring this about. But it will be realized that carrier rockets are not only peaceful instruments, and if the Americans had such advanced carrier rockets they would not be showing them either." He added: "We are doing everything possible to use these carrier rockets for peace, and doing everything to bring about general disarmament. In these circumstances, there would be no barrier for science."

ORBITAL FLIGHTS

	VOSTOK I	VOSTOK II
Launched	Baykonur, Apr. 12, 1961. 7.07 a.m. B.S.T.	Baykonur, Aug. 6, 1961. 7.0 a.m. B.S.T.
Recovered	Saratov area, Apr. 12, 1961. 8.55 a.m. B.S.T.	Saratov area, Aug. 7, 1961. 8.18 a.m. B.S.T.
Number of orbits	1	17½
Flight duration	108 min.	25 hr. 18 min.
Orbit:		
Inclination	64° 57'	64° 56'
Perigee	112.4 miles	110.6 miles
Apogee	203 miles	159.7 miles
Period	89.1 min.	88.6 min.
Spacecraft weight (less final stage)	10,418.6 lb.	10,431.8 lb.
Payload	Major Gagarin, life-support equipment, radio and TV equipment, transmitting on 9.019, 20.006, 143.625 Mc/s. "Signal" transmitter 19.995 Mc/s.	Major Titov, life-support equipment, radio and TV equipment, transmitting on 15.765, 20.006, 143.625 Mc/s. "Signal" transmitter 19.995 Mc/s.
Rocket booster	Multi-stage having "six engines with a total thrust of 20m. h.p. at time of launching" (possibly between 800,000 and 1.3m. lb. initial thrust).	Multi-stage having "six engines with a total thrust of 20m. h.p. at time of launching" (possibly between 800,000 and 1.3m. lb. initial thrust).

Future Programme

The next steps to be taken in the Soviet man-in-space programme will probably be concerned with flights of still longer duration. British United Press, quoting Russian scientific sources on Aug. 6, reported that if Major Titov's mission was successful a more ambitious flight, lasting three to four days, would be attempted. It was thought that this would occur before the 22nd Communist Party Congress in October.

So far as the American space programme is concerned, there is little hope of duplicating Major Titov's triumph for some time. At Cape Canaveral preparations are advanced for launching another unmanned Mercury capsule into orbit early next month. It is expected to make a single orbit of the Earth. When a similar launching was attempted on Apr. 25 this year, the Atlas booster failed to follow its programmed path and had to be destroyed by the range safety officer.

Subsequently, NASA is expected to launch another Atlas-Mercury, this time with a chimpanzee aboard. This should complete three orbits. If successful, a similar triple-orbit mission will then be attempted with one of the American astronauts. It is hoped that this stage will be reached by December or January at the latest.—K.W.G.

Personal Flying

SUITABLE young men are being selected for training either as second officers for Derby Airways, Ltd., or Assistant Flying Instructors for Air Schools, Ltd., in a new scheme introduced by the latter company. Instructors will subsequently be employed at either the Elstree or Derby schools, while candidates for the airline side will be based at Derby or Cardiff with the company's DC-3 fleet. First applicants will start full-time training from Aug. 29, while the second intake, applications for which must be received by Sept. 8, start on Oct. 24.

After initial selection and satisfactory progress in the early stages of training, candidates will be granted financial assistance up to £350, or 25% of the cost of training, as applicable on an interest-free repayment-from-salary basis.

In June, Air Schools training aircraft flew 1,163 hr., 959 of which were at Elstree and 204 at Derby. The Midland School of Flying is to be expanded, and C.P.L. courses provided as at Elstree. The aircraft fleet is moved from one school to the other, as required. At the moment, five Chipmunks and three Austers are operated at Elstree, with two Chipmunks and an Auster at Derby. An eighth Chipmunk is shortly to be introduced.

• • •

McAlpine Aviation, the business flying division of Sir Robert McAlpine and Sons, Ltd., have been appointed sole distributors for Piaggio aircraft throughout the U.K. and Eire. The entire range of Piaggio aircraft will be offered for sale, with particular emphasis on the P.166 executive twin, two of which are operated by McAlpine Aviation for their key personnel.

The company also offer leasing facilities, overhaul and maintenance services at their Luton Airport headquarters, which are being expanded with the construction of a second hangar.

• • •

From A. J. Whittemore (Aeradio), Ltd., of Biggin Hill, the U.K. distributors for Narco radio equipment, comes the news that the Narco lightweight MBT fan-marker receiver and the Mk. V VHF transceiver have both been upgraded to Class I status by the Ministry of Aviation. This means that they can be used at all times, including in controlled air space under IFR conditions, and in public transport category aircraft types.

The MBT-12 is the first lightweight and low-priced fan-marker receiver to be given Class I approval, while the Mk. V 90-channel transmitter and 190-channel receiver is only the second lightweight VHF set to be similarly approved. The MBT is a completely self-contained unit weighing only 18 oz., while the total weight of the Narco Mk. V is 9½ lb.

FLYING FOR TV—A chartered Cessna 310D has been used by the Dunlop company, in conjunction with helicopters to fly TV films back to London from the leading European motor-racing circuits. An account of these activities is on page 180.

• • •

Mr. Arthur Harrison, President of the Warwickshire Aero Club, took delivery of a new Aero 145 light twin towards the end of July, for business use. In his capacity as an insurance broker, Mr. Harrison often flies to the scene of accidents in his own aircraft for first-hand information, and he also intends to use the Aero 145 for business trips to the Continent.

He considers the Aero 145 the best aircraft of its class on the market, and at £13,250 is considerably cheaper than comparable American types. Before taking delivery of the Aero 145, which is based at Birmingham Airport, Mr. Harrison presented his Auster Mk. 5 to the Warwickshire Aero Club.

Gliding Notes

by Dr. A. E. Slater

AT Camphill, on the third day of the Northern Gliding Competitions, the cold front which had arrived the previous midday "came to a grinding halt" and was in "a state of confusion" in the words of Peter Wickham, the met. man. "Rain?" asked a competitor. "The only place where it has been raining to my knowledge is at Camphill," replied Peter. A 100-km. triangle race was set for the afternoon, but in vain.

In compensation, next day, Aug. 2, turned out the best of the meeting, and a distance task along a line through Folkestone was set, as an unstable N.W. airstream had ousted the cold front at last. Alfred Warminger, remembering his cross-Channel flight of a month before, once again declared a goal in Northern France; but, anxious to allow time to get there, he made too early a start, and came down just behind Nottingham. This was the area where, the met. man prophesied, the air would be "flat" to compensate for a big build-up of cumulus over the Pennines to windward.

Most of those who got away (and everybody did) went in two "gaggles" between 11.45 and 12.30, and eight of them landed in Kent. "Chuck" Bentson, of London Club, made the 197 miles to Folkestone in 5½ hours, and Lieut. P. Goldney of the Army Club was just short at Hawkinge. A few miles off course were G. W. Mackworth-Young in his Eagle at Dover, and Stuart Morison of the Army and Chris Riddell of Yorkshire Club at Lympne. D. W. Corrick of Bristol Club landed near Faversham and Don Snodgrass of Lasham reached Sittingbourne.

Mike Bird, unable to use a beautiful cu-nim just over the newly restricted zone near Southend, glided to a good-looking cumulus 20 miles away, but it had died, so he continued the glide into the Isle of Sheppey, gaining enough points to keep his overall lead of the day before.

Goldney reached Hawkinge in a glide from 12,000 ft. north of the Thames, sinking at 6 ft./sec. at first till the ice melted. Other final glides were started by Corrick from near Tilbury and Bentson from an altitude of 9,000 ft. over the Thames.

After a welcome day of rest and rain, a 30-knot surface wind cleared the air for a free distance task on Friday, Aug. 4. With the wind tearing the thermals apart, most people just "scraped" at low altitude, and only Warminger and Bird reached the Lincolnshire coast; but Humphry Dimock got up to 6,000 ft. in a cloud near Boston and glided from there 40 miles to Wisbech, 90 miles from Camphill. This flight earned him 100 points and lifted him from 8th to 5th place, while Bird increased his overall lead from 12 to 72 points.

After another rest day, which suddenly became soarable in the afternoon, Sunday brought promise of a "trough" due to pass over at lunch time. Only Snodgrass got away before it; the task was pilot-selected goal and he declared for Skegness but only reached Sandtoft, 40 miles away.

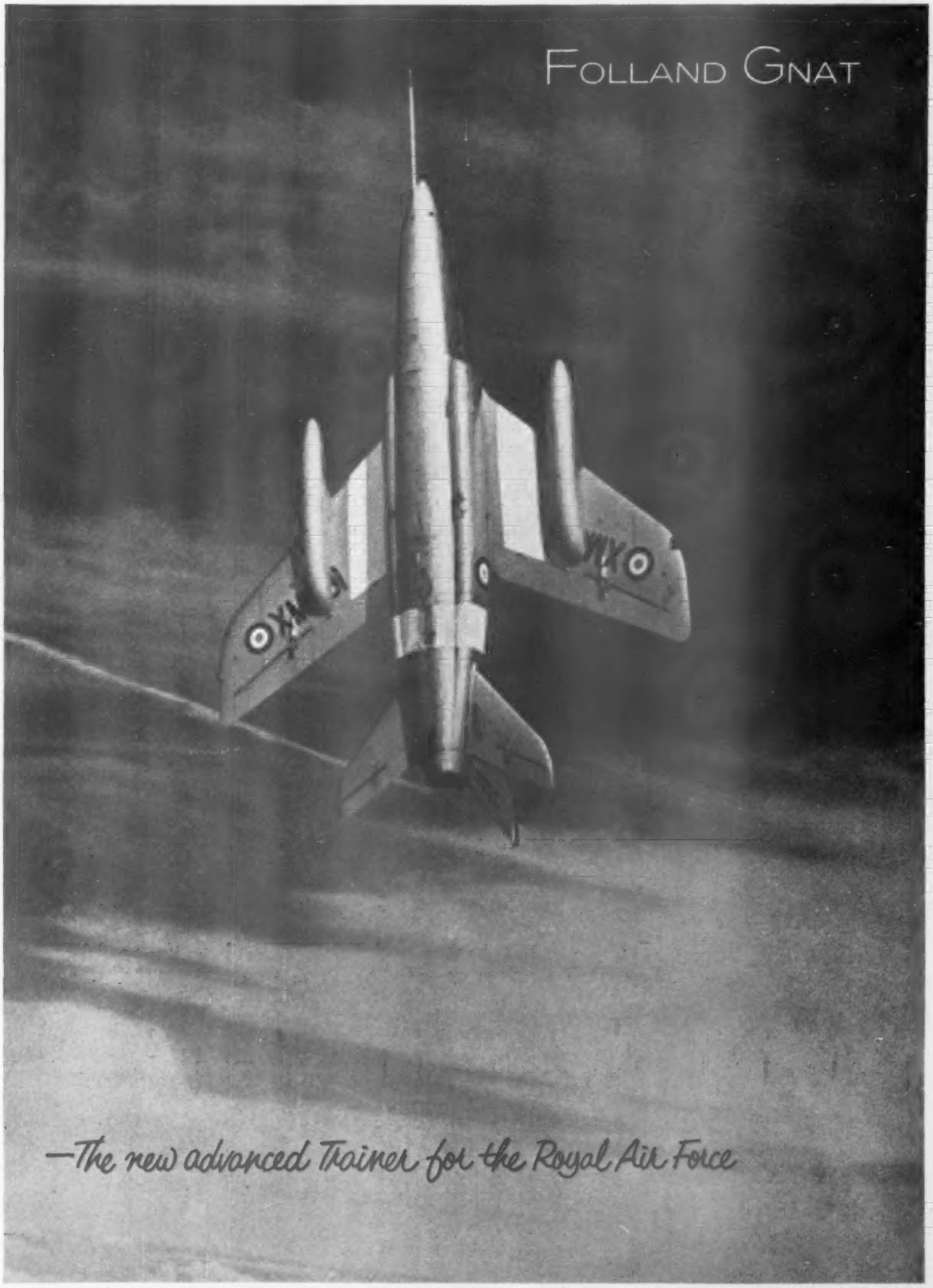
Of 20 post-trough flights, Morison went farthest, 83 miles, but hit the coast north of his goal of Skegness. Dimock, the only one to reach his goal and earn the 30% bonus, went 74 miles to Boston and again became the day's winner.

By this time each pilot had, according to the rules, to discard his worst day's score, with the result that Mike Bird's lead was reduced to 2 points over Dimock and the Morison-Hanneman entry, who jointly held 2nd place.

• • •

DAILY bulletins kindly sent by the Kansas Soaring Association, who are organizing the U.S. Championships at Wichita, describe the first day's weather as "sub-average." However, Dick Schreder, in his new HP-10, won a 142-mile out-and-return race at 35.5 m.p.h. Operations, to quote E. J. Reeves, "went smooth as a cat's ankle. Now it is at last seen that a Major Soaring Operation can be carried on very nicely—smack dab in the middle of a large busy Municipal Airport."

On the second day a high cloud sheet covered the sky and only Bill Coverdale got past the first turning-point of a 148-mile triangle. In these championships pilots have to fly 100 km. (62 miles) to score at all—not a mere 15 or 20 miles as in England. Next day the sky was again covered, this time by low stratus, but Coverdale astonishingly flew 86 miles, explaining that his German Ka-8 was used to European weather and all he had to do was "drop the reins" and follow along.



HAWKER SIDDELEY AVIATION

32 Duke St., St. James's, London, S.W.1

Early Birds—4

S.B.A.C. SHOW FARNBOROUGH STAND 108

Can you name it?

(Answer given below)

Designed by H. P. Folland, this handsome aircraft took to the air as early as 1914, to prove that streamlining was a necessary adjunct to higher speeds. As intended, it was the fastest aeroplane in the world. Powered by a 160 h.p. Gnome engine, closely cowled for minimum drag, it achieved 135 m.p.h. Although one of the first aeroplanes to have flaps, it was still a bit hot on landing . . . a breathtaking 50 m.p.h.! A moulded celluloid canopy was designed, but no pilot could be persuaded to fly under it.

Such research aircraft mark the progress of the aircraft industry. Within our sphere of life-saving, continuous research also keeps pace with the advancing requirements of passenger and service aircraft. Creating better, stronger, lighter fabrics into new designs of inflatable equipment . . . setting new standards of safety . . . is generally **R.F.D.'s** *achievement.*

R.F.D. COMPANY LTD

INFLATABLE
LIFERAFTS
LIFEJACKETS
SAFETY
EQUIPMENT

AIR/SEA SURVIVAL

For further particulars write:—

R.F.D. COMPANY LIMITED, GODALMING, SURREY

Telephone: Godalming 1441. ***M.O.A. Approved and M.O.S. Approved***

Subsidiary Companies in: N. IRELAND, AUSTRALIA, CANADA, AFRICA, FRANCE, NEW ZEALAND, ITALY, HOLLAND, GERMANY, DENMARK, NORWAY, SWEDEN, U.S.A. *(Agents throughout the world.)*

(T.No. S.E.4)

Correspondence

The Vanishing Crews

MR. LENZIE'S article entitled "The Vanishing Crews" in your issue of Jly. 27 is a strange mixture of fact and conjecture which bears little relation to fact, yet the conclusion he reaches that "there appears to be no reason why the flight deck crew should exceed five in number, of whom three should be pilots," is one which would be generally acceptable if applied to long-haul operations, although there is a strong school of thought that would favour a reduction in that number.

It would be impossible, in a letter of this kind, to go into detail to point out the inconsistencies in the arguments adduced by Mr. Lenzie to justify the retention of the navigator and radio officer as crew members, but I would like to draw attention to two basic inaccuracies in Mr. Lenzie's article. He says that the pilot answer to fatigue is to recruit two additional pilots to the crew, one to act as a "meal pilot," the other to act as an "overseer."

If the association is permitted to give the pilots' answer, nothing is farther from the truth. Of the two "answers" given, the second, that an "overseer" pilot should be carried, has not come from the association, which is thoroughly opposed to such a suggestion. In so far as the "meal pilot" is concerned, he is used in B.E.A., as the result of an Industrial Court Award, only when the normal crew, because of commercial requirements, is unable to take a meal on the ground —the additional pilot being carried to ensure that two pilots are at the controls at all times. Neither of the two concepts is basically concerned with the alleviation of fatigue.

On the general question of crew composition the practice, now well established in America, of having an all-pilot crew is becoming universally accepted as providing for greater flexibility and economy in usage, particularly in view of the development of new aids to navigation and communications which do not require a specialist crew member to operate them.

But is not the simple reason why there are more pilots the fact that with the growth of transportation there is a requirement for more?

D. FOLLOWS, General Secretary,
The British Air Line Pilots Association.

Hayes, Middx.

Pilots' Sickness Rates

SINCE C.C.J. has sent me a copy of the letter that he has asked you to publish [see Aug. 10 issue, p. 164] and in it he states he has supplied me, privately, with the authenticity for his statement in the article about which I wrote, I feel I must make a short statement.

I am not satisfied with C.C.J.'s statements regarding the source of his information, since I have access to the correct statistics in connection with the sickness on the Comet 1 Flight and, in addition, in his covering letter to me C.C.J. says—"I feel sure that I did not misunderstand him." (The source from which he obtained the information.) This makes it appear to me that he has, indeed, some doubts on the correctness of his statement that B.O.A.C. planned Comet 1 operations at 85-90 hours per month, per pilot, and that as a result of excessive sickness and medical advice this was reduced.

I would point out, once again, that the planned hours were from the beginning 550 per year and that the average annual hours of pilots was approximately 500; in addition, statistics show that the sickness rate in the Flight was, in fact, lower than that on the Argonaut Flight which was operating at the same time.

Dorney Reach, Berks. A. P. W. CANE (Captain).

Landing a Wellington

IN these days, when one is expected to know more and more about less and less (while continuing, nevertheless, and following the nature of all living creatures, to learn less and less about more and more), it is pleasant to argue about some unimportantly interesting point.

In "OPtional Reading—4" (issue of Jly. 27, p. 94), C. C. J. writes about adding a few knots to the "book" approach speed of a Wellington 1A after hitting the tailwheel rather hard on his first solo.

As I remember it, one of the minor difficulties with the Wellington was caused by the fact that it had a shallow ground angle coupled with an elevator control which was fairly powerful even at low speeds. So the higher the final approach speed the more likely it was that an excessive angle would be obtained, accidentally, during the hold-off.

A really good landing with the Wellington was a bit of a trick, but—for people brought up on the fully stalled, stick-right-back technique—seemed to come off best with a fairly low final approach speed and a half-hearted flare-out, with a whiff of throttle maintained until the thing was firmly on the ground.

London, S.W.3. H. A. TAYLOR.

Lost Luggage

REFERRING to the paragraph headed "Uncivil Aviation" on page 93 of THE AEROPLANE AND ASTRONAUTICS of Jly. 27 regarding the handling of passengers at London Airport, justifiable criticism can also be levelled at the handling of passenger's luggage, and not necessarily on long-distance hauls. Little more than a fortnight ago, for example, I presented myself with one suitcase, with over an hour to spare before a flight to Dublin. At the time, it occurred to me that the receptionist was far more interested in other matters than that for which she was employed.

As it turned out, my supposition was not far off the mark. My case did not arrive with me at Dublin, nor on the next flight either. Telegrams were sent identifying the contents of the case which, fortunately, was not locked; telephone calls were made by the Aer Lingus people. Ultimately the case arrived, many hours later; and it transpired that it had been discovered, still in the baggage hall, not even labelled. Had the case been locked, so that identification would have been more difficult, goodness knows how much more delay there would have been.

One understands from officials at various receiving airports that this is tending to become commonplace at Heathrow.

London, N.W.6. E. H. ROW.

The A.T.L.B. and the Hovercraft

I NOTE with interest that Starways, Ltd., have applied to the Air Transport Licensing Board for licences to operate cross-river services by hovercraft. Why the Air Transport Licensing Board? If hovercraft come under the control of the Minister of Aviation, then he is responsible for controlling them. What could be more ridiculous than ships and hovercraft steaming along busy waterways such as the Clyde or Mersey under completely different control? Imagine an unco-operative River Authority insisting that a line of buoys is essential for the safety of ships and refusing to arrange a gap, even though the buoys make a complete barrier to hovercraft.

There appears to be no case for the Minister of Aviation controlling anything in the airspace normally used by two-dimensional surface craft, be they on land or water. No one would dispute the fact that a hovercraft is two-dimensional for all practical purposes.

Anyway, I'm keen to have one of the hovercraft wheelbarrows I saw demonstrated the other day, but not if it means an endorsement on my A.L.T.P. licence and an A.R.B. exam, a C. of A. and a maintenance schedule, a Licensed Engineer for maintaining it and a list of approved parts which will cost three times the normal charge. Surely the hovercraft principle is just a variant of the pneumatic tyre, and let's leave it at that.

Largs, Ayrshire. ERIC STARLING.

"It's a sort of transistorized 707"

Industry Record

More Automatic Seat-reservation

Some 3,000 telephone callers, 280 counter-callers and 500 telegraph messages will be dealt with per hour by a new electronic automatic seat-reservation system which B.E.A. hopes to have fully operational by the end of 1964. A £2½-million contract for the first part of the system has been concluded between the Corporation and Standard Telephones and Cables, Ltd. This will come into use late in 1963. Ultimate cost of the complete system, which, it is claimed, will be the biggest of its kind in Europe and one of the most modern and fully automated employed by any airline in the World, will be £4¼ million.

Basis of the system will be two pairs of large programme-controlled computers to be installed in B.E.A.'s new permanent West London Air Terminal now under construction. One pair will process reservations on domestic services and the other pair will handle international services—in each case up to nine months ahead of the booking date. Both pairs perform similar functions and are interconnected to allow cross-reference and to duplicate records against equipment failure.

One computer in each pair, known as the numerical computer because most of the information processed is digital, handles all seat availability and seat-booking inventories. The other in each pair, the nominal computer, is concerned with details and requirements of the passengers who have made the bookings. The backing store used with each numerical computer comprises up to 20 high-speed magnetic drums, each able to store records for about 2,000 flights covering an 11-week period. Seat availability information relating to any individual flight may be obtained by sales clerks in the minimum of time.

Each nominal computer has a backing store up to 200 special rapid-access magnetic-tape mechanisms, storing the records for up to one million passengers. Any record may be retrieved for examination or amendment in about five seconds.

Each reservation office which is connected to the system will have a number of push-button seat-availability and booking interrogation units, and a special teleprinter for transmitting details to the nominal computer. Initially only reservations clerks in the London area will be connected directly to the computing centre. Bookings made through other B.E.A. offices and by other airlines will still be telegraphed to the London centre, but these messages will in future be automatically processed by the computers. Later it is planned to provide direct connections, over leased land lines, for other principal B.E.A. offices in the United Kingdom and also those on the Continent.

With the complete system in use B.E.A. believe that, during peak booking months, there will be complete elimination of more than 500,000 reservation record cards, 100,000 flight control sheets and well over a million booking entries which would otherwise have been made by hand.

Similar systems ordered from Standard Telephones—a seat-reservation system for B.O.A.C. and a load control and passenger check-in system for S.A.S.—were briefly described in our issues for Apr. 20 and 27 respectively.

Mr. A. H. Milward, chief executive of B.E.A., left, and Mr. K. A. F. Frost, group manager of Standard Telephones, examine a reservations key-set.

Aviation Calendar

Aug. 29

Luton Airport.—International Light Aircraft Exhibition; until Sept. 2.

Sept. 1

London.—B.I.S. lecture, "Man in Space," by Dr. J. C. Guignard, I. B. Wright and Dr. W. F. Hilton, at the Royal Society of Arts, John Adam Street, W.C.2, at 18.30 hr.

Sept. 3

Wolverhampton.—Wolverhampton Aero Club At Home.

Sept. 4

Farnborough.—S.B.A.C. Exhibition and Flying Display; until Sept. 10. (Public days Sept. 8-10.)

Sept. 8

Cranfield.—Popular Flying Association Rally; until Sept. 10.

Sept. 13

Baden-Baden.—German Aero Club Second International Sporting Pilots' Rally.

Company Notices

NEW COMPANIES

Jack Braithwaite (Aerial Photography), Ltd. (700,056).—Private co. Reg. Aug. 3. Cap. £100 in £1 shs. Directors: Jack Braithwaite and Sheila Braithwaite, both of 69 Oxford Street, Woodstock, Oxford. Nicholas Isidoros, Oxford Airport, Kidlington, Oxford. Sec.: J. Braithwaite. Reg. off.: Oxford Airport, Kidlington, Oxford.

South Eastern Aviation, Ltd. (699,352).—Private co. Reg. Jly. 26. Cap. £100 in £1 shs. To act as importers, distributors of aircraft and all components thereof. Directors: John E. Underhill, 3 St. Mary Avenue, Earley, Reading. Anne C. Underhill, 16 Culver Lane, Earley, Reading. Sec.: C. J. Hayward. Reg. off.: 48 Market Place, Reading.

Trisons Aircraft, Ltd. (699,270).—Private co. Reg. Jly. 25. Cap. £100 in £1 shs. To operate air transport services. Directors: Kenneth Carter, 20 Broadfield Way, Buckhurst Hill, Essex. Cyril W. Loftus, Westways, Hainault Road, Chigwell, Essex. Sec.: K. Carter. Reg. off.: 164 Bishopsgate, E.C.2.

A. J. Walter (Aviation), Ltd. (699,050).—Private co. Reg. Jly. 21. Cap. £1,000 in £1 shs. To carry on the business of manufacturers of and dealers in components, parts, engines and apparatus used in connection with prototype and experimental aircraft and aircraft of all kinds. Sec.: W. H. Boultwood.

New Patents

APPLICATIONS ACCEPTED

877,740.—**W. W. Triggs (Goodyear Aircraft Corporation).**—"Fuel cell for inflatable aircraft." Sept. 23, 1959.

877,766.—**Soc. Bertin and Cie.**—"Jet augmenters." Aug. 13, 1958. (Aug. 28, 1957.) (Addition to 847,500).

877,838.—**Rolls-Royce, Ltd.**—"Gas turbine engine air intakes." May 31, 1960. (Aug. 20, 1959).

Printed specifications of the above will be available on Sept. 20, 1961, and the opposition period will expire on Dec. 20, 1961.

Personal Notices

BIRTHS

Briggs.—On Jly. 23, at Albrighton, Staffs, to Nancy, wife of Flt. Lt. D. A. Briggs—a daughter.

Knight.—On Jly. 31, at R.A.F. Hospital, Halton, to Paule, wife of Flt. Lt. G. Knight—a son.

Phillips.—On Jne. 27, at Shipton-under-Wychwood, to Joan Mary, wife of Flt. Lt. G. M. Phillips—a son.

Tapster.—On Jly. 29, at Devizes, to Olive, wife of Flt. Lt. P. R. Tapster—a son.

Luftwaffe Fire-control

Evaluation models of the Ferranti I.S.I.S. (integrated strike and interceptor system) aircraft fire-control system are to be delivered to the Luftwaffe under a recently concluded contract between the company and the West German Ministry of Defence. Four different versions of the I.S.I.S. will be tested in Fiat G-91s, more than 300 of which are at present on order for this air force.

I.S.I.S., developed at Ferranti's Edinburgh laboratories, is a simple lightweight system for aiming guns, rockets, and bombs. It is independent of any radar equipment and uses a gyroscopic method of measuring range to surface targets. In some versions of I.S.I.S. the sight can also be used to present steering signals to the pilot from a navigation computer. The steering signals, whether for navigation or weapon aiming, are presented "head-up," so that the pilot sees them in his normal field of view as he looks forward out of the cockpit.

The I.S.I.S. gunsight is a development of the Ferranti Gyro Gunsight, over 50,000 of which have been produced and supplied to more than 30 of the World's air forces.

Another Spraymat Licence

Spraymat, the electrical deicing system developed by D. Napier and Son, is to be manufactured in Japan. As the result of a recently signed licence agreement Shin Mitsubishi Heavy Industries, Reorganized, Ltd., of Tokyo, have been granted exclusive rights. Japanese personnel are shortly to undergo training at Napier's Luton factory and production will begin in Japan early next year. Initial production will be for the 177 nationally built F-104J Starfighters for the Japanese A.S.D.F. for which Shin Mitsubishi are prime contractors.

Spraymat is also produced under licence in France, West Germany and the U.S.A.

Electronics Take-over

Ultra Electronics, Ltd., has reached provisional agreement with K.G. (Holdings), Ltd., to acquire the entire share capital of its subsidiary, W.S. Electronics, Ltd., for approximately £125,000, the effective date of purchase to be Jly. 31. It is the intention of Ultra to continue the business of W.S. Electronics as a separate entity within the group.

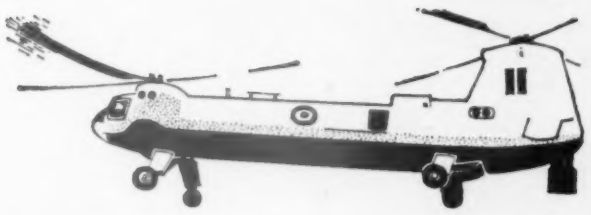
Computers on Show

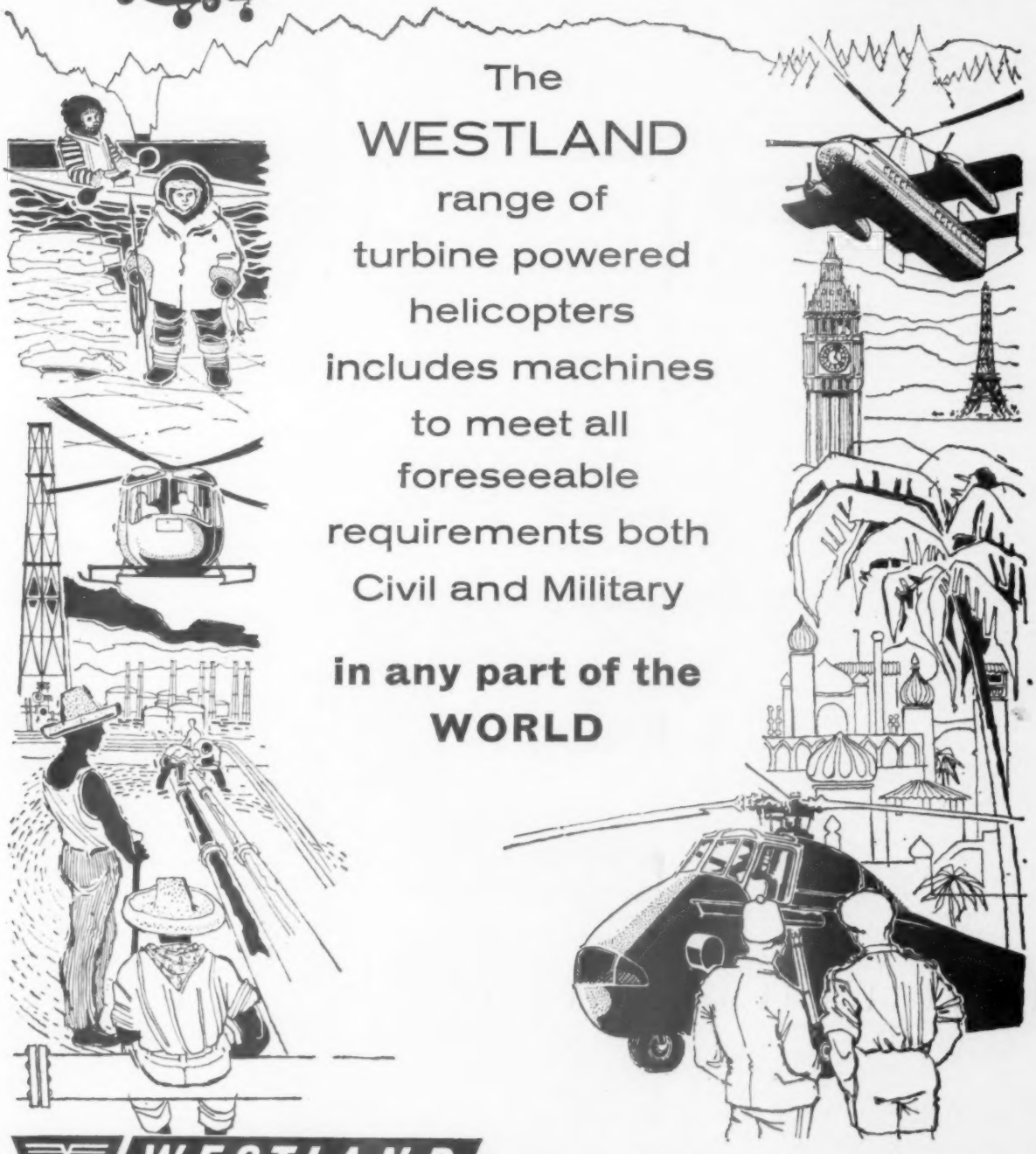
Olympia, London, is the venue for the Electronic Computer Exhibition to be held from Oct. 3-12. Thirty-seven leading British manufacturers in the computer field will be showing their equipment which will be grouped into two broad categories—standard production computers and those units specially designed for large-scale data-processing, scientific and research work. An electronic data processing symposium will run in parallel with the exhibition. The last such exhibition was held in 1958.

Checking Component Accuracy

The rapid close-tolerance inspection of large components, for which there is an ever-increasing requirement in the aircraft industry, has brought about the joint development of the AM. 7236 universal automatic measuring machine by High Precision Equipment, Ltd., and Ferranti, Ltd. This machine is capable of inspecting a variety of component types such as large template shapes, three-dimensional forms, including aerofoils and wind tunnel models, and large castings within an overall capacity of 72 in. by 36 in. by 24 in.

The machine incorporates the numerical positioning control equipment on the horizontal axes of measurement together with a specially designed measuring system in the "Z" or vertical axis. This measures a displacement from a horizontal datum. A continuous display of position on all three axes is provided and other facilities, such as paper tape or manual decade dial information input and overall manual control of all slide movement, are incorporated. There are facilities to give output signals for print-out or Hollerith punched card equipment.





The
WESTLAND
range of
turbine powered
helicopters
includes machines
to meet all
foreseeable
requirements both
Civil and Military

in any part of the WORLD

WESTLAND *the great name in* **HELICOPTERS**

WESTLAND AIRCRAFT LIMITED YEOVIL ENGLAND

Incorporating SAUNDERS-ROE DIVISION, BRISTOL HELICOPTER DIVISION and FAIREY AVIATION DIVISION

CLASSIFIED ADVERTISEMENTS

PRESS DAY: Classified Advertisements must normally be received at Head Office by FIRST POST THURSDAY for the following Thursday's issue. Last-minute additions and deletions are accepted by telephone from trade advertisers up to noon. Advertisements received too late for a particular issue are automatically inserted in the succeeding one unless instructions to the contrary are received.

RATES—1/- per word (minimum 12 words 12/-). Each paragraph charged separately and name and address must be paid for. Semi-displayed setting £3-17-6 per single column inch. Centred lines 22/6. Series discounts of 5% for 13, 10% for 26 and 15% for 52 consecutive insertions, allowed to trade advertisers.

TERMS—Strictly net and prepayable. Monthly accounts for settlement by the end of the month following insertion are allowed to trade advertisers if satisfactory references are provided.

REMITTANCES—Cheques and postal orders should be crossed and made payable to TEMPLE PRESS LIMITED and instructions sent addressed to the Manager, "The Aeroplane and Astronautics," Bowling Green Lane, London, E.C.1.

DEPOSIT SYSTEM—Facilities are available to readers to purchase advertised goods through "The Aeroplane and Astronautics." Commission 1% (minimum 2/-) on amount deposited.

BOX NUMBERS—Private advertisers desiring to have replies sent care of "The Aeroplane and Astronautics," may do so on payment of 1/- to cover booking and postage, plus cost of four extra words. Box Numbers must not be used for the purpose of circularizing and the Proprietors do not undertake the distribution of such matter received. To avoid mistakes in forwarding, Box Numbers should be carefully and legibly copied and replies sent to Box A000, care of "The Aeroplane and Astronautics," Bowling Green Lane, London, E.C.1.

THE PROPRIETORS retain the right to refuse or withdraw advertisements at their discretion and are not responsible for clerical or printers' errors, although every care is taken to avoid mistakes.

HEAD OFFICES: Bowling Green Lane, London, E.C.1, England. Telephone: Terminus 3636. Telegrams: "Pressimus London Telex." Telex: 23839.

BRANCH OFFICES: Bayliss House, Hurst Street, Birmingham, 5. Telephone: Midland 6616. 50 Hertford Street, Coventry. Telephone: Coventry 27414. 1 Brazennose Street, Manchester. Telephone: Deansgate 6114-8. 12 Renfield Street, Glasgow. Telephone: Glasgow Central 1413.

AIRCRAFT FOR SALE

RAPIDE, ex Marshall Fleet. Delivery 14 days from order with 12 months public transport C. of A. X5 propellers (new), A.U.W. 6,000 lb. low-houred engines, radio. Extremely well maintained and in excellent condition. Marshall Flying Services, Ltd., The Airport, Cambridge. 600-644

A Messenger Mk. IV, built in 1947, new 3-year C. of A., low engine hours, engine-driven generator, self-starter, radio Murphy MR80, 23-channel V.H.F., blind-flying panel, dual control, twin-tread anti-shimmer tail wheel assembly, recently upholstered in red leather and cream washable head lining, new bubble windscreen, all glass excellent, whole aeroplane in first-class condition, £2,200 or near offer, would exchange. Heron, Rover House, Bournemouth. Phone 24433. 601-650

PRENTICE 7-seater aircraft, fitted radio, cabin heater, immaculate, C. of A. expires July, 1964, £1,850. Box A992, care of THE AEROPLANE AND ASTRONAUTICS. 600-x6284

MILES MESSENGER 4-seater, Cirrus Major engine, 32-channel Murphy radio, generator, starter, full panel, retrimmed inside, first-class condition, C. of A. February, 1962, £1,600. Phone, Cop 4201. 600-x6474

FOR sale. Two Tiger Moth aircraft equipped for agricultural work: Britten-Norman Micronair rotary atomizers and fertilizers spreading equipment, C. of A. expiring September, 1961, £500; C. of A. expiring February, 1962, £700. Both aircraft available for inspection at Sywell by appointment. Apply Crop Culture (Aerial), Ltd., Bembridge Airport, I.o.W. 600-5

ONE PBY-5A, two crew, cargo doors and floor, extra windows, removable airline seats and tables, galley, etc., no corrosion, new C. of A. on delivery; available now. Apply Box A896, care of THE AEROPLANE AND ASTRONAUTICS. 600-16

UNIQUE opportunity. Two-seat Auster J.4, immaculate condition inside and out, only 10 hr. since recent three-year C. of A., Cirrus Minor I engine has 300 hr. to go, gyro instruments fitted, £775. Box A004, care of THE AEROPLANE AND ASTRONAUTICS. 600-15

I.A.T.A. Carrier disposing number of D.C. 6A and D.C. 6B aircraft fitted long-range tanks, hours flown average 10,000 hours since date of manufacture, 1956-57, these aircraft are on progressive maintenance and condition is immaculate. Enquiries to sole European agent: Killock Martin Air, Ltd., 20 Mark Lane, E.C.3. Min 3100. 600-13

PETER S. CLIFFORD AND CO., LTD., offer:—

META-SOKOL demonstrator, 125 hours since new, to standard specification, plus blind flying instruments, full 4-seater, list £4,885, offered £4,550, immediate delivery.

DETAILS of a number of second-hand aircraft on request.

SOLE U.K. agents for Czechoslovakian light aircraft.

OXFORD AIRPORT, Kidlington, Oxford. Kidlington 3355, Bletchington 392. 600-14

PRENTICE. Long-range tanks, steel rod gator, many extras, seen Newcastle Airport. Offers. Dr. J. McClory, Stamfordham House, Stamfordham Rd., Newcastle-on-Tyne. 603-653

Aircraft Wanted

SCRAP aircraft aluminium and stainless steel urgently required. Lowton Metals, Ltd., Lowton St. Mary's, near Warrington, Leigh 71441-2. zzz-0766

GIPSY engine AUSTER, low engine hours, public transport C. of A., condition not important. West London Aero Club, White Waltham Airfield, Berks. Littlewick Green 272. 600-x6204

AIRCRAFT ACCESSORIES, SPARES AND COMPONENTS

PHILLIPS AND WHITE, LTD.

THE leading stockists in the U.K. for instruments, navigational equipment, electrical components and parts, and engine accessories. Spares for de Havilland Gipsy, Major and Queens series and Armstrong Siddeley, Cheetah IX and XV engines.

61 QUEENS GARDENS, London, W.2. Phone, Ambassador 8651, 2764. Cables, "Gyrair London." zzz-772

THE REGIONAL AIR TRADING CO., Croydon Airport for Rapide spares of every description. Phone, Croydon 8521. zzz-798

AIRFRAME spares for Dakotas, Harvards, Piper Cub, Fairchild Argus, Beechcraft, D17s, Mosquito, Spitfire, Firefly. Engines spares for Pratt & Whitney, Armstrong Siddeley, Lycoming, etc.; accessories and instruments for all types of aircraft.

C.47 Dakota operators please note, we offer a limited number of genuine brand-new Bendix 52O58 tail wheels at a reasonable price.

A. J. WALTER, LTD., The Drive, Horley, Surrey. Phone, Horley 1420 and 4294. Cables, "Cubeng Horley." 600-8

Cessna

APPOINTED DEALERS

The North & West Midlands: Westair Limited, Squires Gate Airport, Blackpool, Lancs.

East Anglia & East Midlands: W. H. & J. Rogers (Engineers) Ltd., Gt. Barford, Bedford.

West: Steels (Aviation) Limited, Clifton, Bristol.

Scotland: Airwork Services Limited, Perth Aerodrome, Perth, Scotland.

SOLE DISTRIBUTORS IN GREAT BRITAIN ARE

AIRWORK SERVICES

PANSHANGER AERODROME · HERTFORD

TELEPHONE: ESSENDON 315

Airline Air Spares LTD.

Airline Air Spares can meet your requirements, as we have recently stripped one of these aircraft completely and can offer many attractive items ex stock.

Our Spares stockholding includes comprehensive ranges for DC4, Viking and Bristol 170 aircraft, and we also supply workshop and ground equipment.

AIRLINE AIR SPARES LTD.,

Associated with

KEEGAN AVIATION LTD.,

SOUTHEND AIRPORT, SOUTHEND-ON-SEA, ESSEX.

PHONE SOUTHEND 48183. TELEX 1943.

Our Ansafone telephone answering machine records all telephone calls after office hours.

SURPLUS test equipment for sale. Hydraulic pneumatic vacuum, electrical, low temperature, instrument, propeller, tensile, impact, creep, crack detection, etc. Send requirements. L. Solloman, Ltd., 1 Beaufort St., Manchester, 3. Phone, Blackfriars 4571. 609-634

QUANTITY of Tiger Moth spares. Gipsy Major engines and engine spares and propellers for sale. Inspection invited. Crop Culture (Aerial), Ltd., Bembridge, I.o.W. 600-6

Aircraft Accessories, Spares and Components Wanted

WANTED, PD 190/212/1 feathering propellers and propeller parts for Heron. Box 2183, Anchorage, Alaska. 601-637

EKCO 1140 V.H.F. main unit only. Box A002, care of THE AEROPLANE AND ASTRONAUTICS. 600-4

LINK TRAINERS

LINK trainers (12). Low price for prompt removal. Offers. Box A003, care of THE AEROPLANE AND ASTRONAUTICS. 601-x6473

AVIATION COMPUTERS

KAYS, of Ealing, stockists of Aristo, Jeppersen, Weems, Swissair, R.A.F. Mk. 4, Box Dalton, computers; scale rules, protractors, etc.; quotations, mail orders by return. Write for latest stock list, 8-10 Bond St., Ealing, W.5. Eal 2813. 600-787

CARS FOR SALE

YOUR aeroplane taken in part-exchange for any of our 400 used cars or 100 new cars always in stock. If your plane is worth more than the car or deposit required for a hire-purchase transaction we will gladly refund the cash difference. Raymond Way, Kilburn, London, N.W.6. Maida Vale 6044. 600-790

CLOTHING

R.A.F. Officers' uniforms, for sale, new and reconditioned. Fisher's, 86-88 Wellington St., Woolwich. Phone 1055. Kits also purchased. zzz-774

CONSULTANTS

IAN S. McNICHOL, London School of Air Navigation. Pilot and navigator training with advisory service. 33 Ovington Square, Knightsbridge, S.W.3. zzz-791

R. W. SUTTON (CONSULTANTS), LTD., 7 Lansdowne Place, Cheltenham. Phone 5811. 600-602

HIRE AND CHARTER

AUSTER, Tri-Pacer, Cub, Apache available. Grantair, Ltd., Sywell Aerodrome, Northampton. Phone, Moulton 3481. 600-795

MISCELLANEOUS

LANCING BAGNALL mechanical aircraft handlers, jet engines for Mk. V Sabre, 2,000 various magnetos, tyres 56 x 16, 17.0 x 16, 15.50 x 20 43-in. Details, J. T. Leavesley, Ltd., Alrewas, Staffordshire. Phone, Alrewas 354-5-6. 600-648

PACKING AND SHIPPING

R. AND J. PARK, LTD., Dominion Works, Thames Rd., Chiswick, London, W.4. Phone, Chiswick 7761. Official packers and shippers to the aircraft industry. zzz-0782

RADIO AND RADAR

STR12D, STR9Z, STR9X and most other British and American V.H.F. R/T equipment always in stock. A.R.B.-approved design installations into any type of aircraft. A. J. Whittemore (Aeradio), Ltd., Biggin Hill Aerodrome, Kent. zzz-781

SITUATIONS VACANT

ADEN AIRWAYS (B.O.A.C. Associate). Due to continued expansion with the impending introduction of the Avro 748 Aden Airways are seeking additional licensed aircraft engineers. Essential qualifications are sound practical experience, A licence on DC3, Argonaut and/or C licence on P. and W. 1830 and R.R. Merlins. Turbine experience or licences a considered advantage. Salaries in the range of £1,548 to £1,938 per annum dependent upon qualifications and experience, with income tax paid, free furnished accommodation for both married and single engineers, 60 days U.K. leave per annum free passages for successful applicant and his family, together with generous contributory pension/provident and medical schemes. Engineers interested in an interview are asked to forward full details of qualifications and experience in strict confidence to Personnel Manager, B.O.A.C. Associated Companies, Airways Terminal, Buckingham Palace Rd., London, S.W.1. 600-643

WANTED. Link Trainer Instructor. Apply Training Administrator, Air Safaris, Ltd., Gatwick Airport South, Horley, Surrey. 600-649

TRADAIR, LTD., require licensed and unlicensed aircraft electricians with Viscount experience. Please apply to:—Chief Engineer, Tradair, Ltd., Southend Airport, Essex. 601-652

Keegan Aviation LTD

What we advertise we own

We have a complete range of British and American business aircraft in stock for immediate delivery . . . . . .

Also available a permanent lease fleet comprising D.C.4's, Viscounts, Bristol 170's, Vikings and D.C.3's.

Send for full illustrated details.

Keegan Aviation LTD

Panshanger Aerodrome, Hertford
Telephone: ESSENDON 491 2 3
Cables: PLANESALES HERTFORD
Telex: 1943

DOUGLAS C47 DAKOTA
FOR SALE
ASTRAEUS LIMITED
167 Victoria Street
London SW1
Phone VIC 1403 Cable Arreffay

There is a JODEL for you.
Either the **AMBASSADEUR** 3 seater or the **MUSKETEER** 4—5 seater.
U.K. Agents:
ROLLASON AIRCRAFT & ENGINES LTD.
REDHILL AIRPORT • • • SURREY
Telephone: NUTFIELD RIDGE 2212

BRITAIN'S ONLY AVIATION SCHOOL
AIRWORK SERVICES TRAINING PERTH
offering *all* these courses:—
* commercial and private licences
* instrument rating
* aircraft engineering
* full residential facilities
MINISTRY OF AVIATION APPROVED
Airwork Services Ltd.,
35 Piccadilly, London, W.1.

Situations Vacant—contd.

A And C Viking licensed engineer required immediately for station engineer duty in Nicosia, small base, salary in region of £1,100 plus allowances, free passage out and return. Apply in writing to The Chief Engineer, Cunard Eagle Airways, Ltd., London Airport, Hounslow, Middlesex. 600-2

NIGERIA AIRWAYS have vacancies for First Officers for D.C.3s, possible command flying on Piper Aztec aircraft if applicant has sufficient experience and holds Senior Licence, salary in range £2,045 to £2,360, including inducement pay, generous gratuity scheme, education allowances, accommodation provided and medical facilities, free passages for wife and up to two children. Applications invited immediately to Nigeria Airways, 32 New Bond St., London, W.1. 600-7

C.F.I. Wanted, club near London, excellent remuneration and prospects. Phone, Coppermill 3345-6 or write Box A952, care of THE AEROPLANE AND ASTRONAUTICS. 600-9

FLYING instructor at Exeter Airport, good salary, pension fund. Apply to the Manager, Exeter Airport, Exeter. Phone, Exeter 67433. 600-11

AVIATION engineer required by consultant engineers advising on aircraft design and manufacture and airline operations, age 20-25, minimum qualifications H.N.C. (Mechanical or Aeronautical) with appropriate apprenticeship. Write giving full details of experience to Hedley S. Crabtree and Co., Ltd., 144 Cromwell Rd., S.W.7. 600-12

TUITION

AVIGATION, LTD., provide full-time or postal tuition or a combination of these methods for M.C.A. Pilot-Navigator licences. Classroom instruction can be provided for A.R.B. General, certain specific types and performance schedule examinations, D4 Links. Phone, Rodney 8671. For details apply Avigation, Ltd., 30 Central Chambers, Ealing Broadway, London, W.5. Ealing 8449. zzz-771

LONDON SCHOOL OF AIR NAVIGATION offers full-time personal coaching with home-study correspondence courses or combination of both for all aspects of professional pilot and navigator qualifications, also P.P.I. Officially appointed Services Courses Scheme, 33 Ovington Square, Knightsbridge, London, S.W.3. Ken 8221. zzz-792

DENHAM LINK TRAINING CENTRE, D4 and ANT 18 Trainers. Instrument ratings, renewals and latest procedures for flights to any aerodrome in the world. 21s. an hour. Denham 3171. zzz-797

BEDFORDSHIRE AIR CENTRE, Cranfield, Bedford (three miles from Motorway M1). First-class flying facilities and instructors, fly the modern Cessna 150 and 172 aircraft. Hangarage and service facilities for your aircraft available. Write to the Secretary for details or phone Ron Campbell, Cranfield 321, extension 304. 600-640

LEARN to fly, £37; Instructors' Licence and Instrument flying for £4 12s. 6d. Night flying £5 12s. 6d. per hour. Residence 6 gns. weekly. Specialized course for Commercial Pilot's Licence. Wiltshire School of Flying, Ltd., Thruxton Aerodrome (Andover Junction 1 hr. 15 min. from Waterloo), Hants. zzz-799

INSTRUMENT rating, contact the acknowledged experts for D4 Link and flying trainers in London and at Oxford Airport, Link Training Services, Ltd., Cobs Court, Carter Lane, Ludgate Hill, E.C.4. Phone, City 6043. 611-651

PILOT TRAINEES

APPLICATIONS are now being considered for a second batch of young men for training and subsequent employment as (i) Second Officers for Derby Airways, Ltd., or (ii) Assistant Flying Instructors for Air Schools, Ltd. Each successful candidate, who must be prepared to start on a comprehensive full-time course from October 24, 1961, will be given financial assistance to a maximum of £350 or 25% of the cost of training, as applicable, on an interest-free repayment-from-salary basis.
FORMS of application, which must be returned not later than September 8, are obtainable from the London School of Flying, Ltd., The Aerodrome, Elstree, Herts. 600-1

FLYING training from 50s. per week. Club facilities. Central Line or 10 bus. Herts and Essex Aero Club, Stapleford, near Abridge, Essex, Stapleford 257. 600-3

SOUTHEND-ON-SEA MUNICIPAL FLYING SCHOOL offers comprehensive training for commercial and private pilots in atmosphere of modern air transport. Rates from £4 (contract). No entrance fees. Airport club available. Municipal Airport, Southend-on-Sea. Phone, Rochford 56204. 600-793

30/- Per hour for dual or solo flying on Tiger Moth aircraft. Annual subscription required. Phone, Biggin Hill 2773. Uxbridge Aero Club, Biggin Hill. 600-10

CLUB NOTICES, ETC.

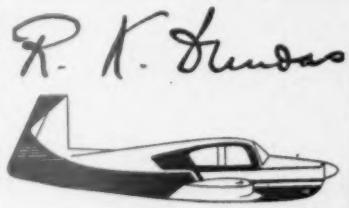
SURREY AND KENT FLYING CLUB, Biggin Hill (BN9) 2255. M.o.A.-approved course. Tiger and Hornet Moths, Chipmunk and Prentice. Contract rates. Route 705, one hour from Victoria. 600-761

BOOKS AND PUBLICATIONS

"CAMERA IN THE SKY," by Charles Sims, with a preface by Air Chief Marshal Sir James Robb. For more than 30 years Charles Sims, chief photographer of THE AEROPLANE AND ASTRONAUTICS and one of Britain's best-known aerial photographers has watched the amazing growth of British aviation from a ring-side seat. In this book he recalls with pen and camera, enlivened with anecdotes, some of his many memories of those eventful days. Illustrated, 218 pages, 25s. net from booksellers, or 26s. 6d. by post from the publishers, Temple Press Limited, Bowling Green Lane, London, E.C.1. zzz

PRINCIPLES OF HELICOPTER ENGINEERING, by Jacob Shapiro. This comprehensive review of the engineering principles governing the design and construction of helicopters provides a complete survey of recent knowledge in the field. Illustrated, 448 pages, 55s. net from booksellers, or 56s. 9d. by post from the Publishers. Temple Press Limited, Bowling Green Lane, London, E.C.1. zzz

"AEROPLANES AND AERO-ENGINES," (4th Edition). A new edition comprising 24 two- and three-page cutaway drawings which includes a variety of British civil and military aircraft and 10 piston-engine, jet and gas-turbine power plants. Illustrated, 56 pages. Price 5s. net from booksellers or 5s. 7d. by post from the publishers, Temple Press Limited, Bowling Green Lane, London, E.C.1. zzz



TOP PERFORMANCE!!!
1,030 POINTS OUT OF 1,500
IN THE
INTERNATIONAL BUSINESS AND TOURING AIRCRAFT COMPETITION, 1961

For sheer performance, the Mk.21 came first in the distance event, out of 20 different types.

We have pointed out Mooney performance before, and now proved it publicly. At **£7,718 basic**, it carries the lowest price tag for any aircraft of comparable performance. **Please note** no increase in price with recent increase of Import Duty!! We invite you to check on others first, then you'll want Mooney.

R. K. DUNDAS LTD.
DUNDAS HOUSE,
59 ST. JAMES'S STREET,
LONDON, S.W.1

CUNARD EAGLE AIRWAYS LIMITED
LONDON (Heathrow) AIRPORT • HOUNSLOW MIDDX.
require

'A' LICENSED RADIO ENGINEERS
(Ref.: M.13.)

'X' LICENSED INSTRUMENT ENGINEERS
(Ref.: M.4.)

INSTRUMENT MECHANICS
(Ref.: M.18.)

SKILLED AIRFRAME & ENGINE FITTERS
preferably with experience Britannia Viscount or DC.6 aircraft
(Ref.: M.1.)

RADIO MECHANICS
(Ref.: M.3.)

All Applications in writing, quoting the appropriate reference, to the Personnel Officer

BRITISH
WIRE THREAD INSERTS
Precision made in Carbon Steel for Aluminium and Magnesium. Also in Stainless Steel and Bronze.
B.S.F. • Metric • B.S.P. • B.A.
Whitworth • Unified
CROSS MANUFACTURING CO. (1938) LTD
COMBE DOWN BATH SOMERSET

MINISTRY OF AVIATION
AIR TRAFFIC CONTROL OFFICERS
Posts for men or women at least 23 and under 35 on 1/7/61. Candidates must have had recent aircrew experience, preferably as pilot or navigator in civil air transport or H.M. Forces; but exceptionally, extensive experience in A.T.C.O. duties may be accepted. They should normally also have G.C.E. with five passes, or an equivalent academic qualification. Starting salary (London) from £872 to £1,251. Maximum £1,599. Appointment initially unestablished, but prospects of establishment and promotion.
Apply:
MINISTRY OF AVIATION
EST 5(a) 1/R 788, THE ADELPHI
JOHN ADAM STREET, LONDON, W.C.2

Books and Publications—contd.

"THE AEROPLANE" PICTORIAL REVIEW (No. 5). Staff of THE AEROPLANE AND ASTRONAUTICS. This fifth annual collection of outstanding aviation pictures contains over 200 photographs grouped in 12 sections and descriptively captioned. Illustrated, 128 pages, 12s. 6d. net from booksellers, or 13s. 7d. by post from the publishers, Temple Press Limited, Bowling Green Lane, London, E.C.1. Other volumes available in this Series. THE AEROPLANE Pictorial Review, No. 3, 10s. 6d. net (post free, 11s. 7d.) THE AEROPLANE Pictorial Review, No. 4, 12s. 6d. net (post free, 13s. 7d.). All other volumes in this series are now out of print. zzz

THE "POWER AND SPEED" SERIES FOR BOYS. "Aircraft and Air Power," by F. G. Swanborough of THE AEROPLANE AND ASTRONAUTICS, has been written for intelligent boys between the ages of 10 and 16. The author surveys modern military flying and includes chapters on combat aircraft, scientific aids and missiles. Other titles in the Series are: "Motorcars," "Locomotives" and "Ships and Shipbuilding." Illustrated, 112 pages, 10s. 6d. net from booksellers, or 11s. 5d. by post from the publishers, Temple Press Limited, Bowling Green Lane, London, E.C.1. zzz

INTERPLANETARY FLIGHT. An Introduction to Astronautics (2nd Edition), by A. C. Clarke. Completely revised in the light of recent advances in the science of astronautics. Includes a chapter on earth satellites and lunar probes and an appendix on fundamental theory and mathematical data. Illustrated, 152 pages, 12s. 6d. net from booksellers, or 13s. 4d. by post from the publishers, Temple Press Limited, Bowling Green Lane, London, E.C.1. zzz

THE EXPLORATION OF SPACE (First Cheap Edition), by A. C. Clarke. Provides answers to the many questions the intelligent layman asks about the science of astronautics. Over 375,000 copies sold in all editions. Illustrated, 212 pages, 8s. 6d. net from booksellers, or 9s. 5d. by post from the publishers, Temple Press Limited, Bowling Green Lane, London, E.C.1. zzz

MODERN AIRCRAFT DESIGN, by J. L. Naylor. Provides technicians in allied industries with an account of the wide background of knowledge behind the design of modern aircraft. Illustrated, 128 pages, 9s. 6d. net from booksellers, or 10s. 2d. by post from the publishers, Temple Press Limited, Bowling Green Lane, London, E.C.1. zzz

New Luxury Hotel & Country Club
NEAR FARNBOROUGH
Single, Double Bedrooms and Private Suites
Charcoal Grill
HOLLIS COURT HOTEL AND COUNTRY CLUB
MAYFORD, GUILDFORD ROAD (A320)
Nr. WOKING, SURREY
Tel.: WOKING 5695

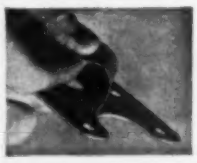
AIR TRAFFIC CONTROL
Experienced
RUNWAY CONTROLLER/ A.T.C. ASSISTANT
required for duties at White Waltham Aerodrome at Maidenhead, Berks.
Interesting work covering movements of civil and military, fixed and rotary-wing aircraft.
Please apply to the Manager,
FAIREY AVIATION LIMITED
at the Aerodrome, giving details of experience.
(A Division of Westland Aircraft Limited)

SITUATION VACANT
SALES MANAGER
required for aircraft and component sales organization with world-wide business. Good opportunity and prospects for experienced man with drive and initiative.
Please reply to Box No. A001, c/o "The Aeroplane & Astronautics", Bowling Green Lane, London, E.C.1

CHOOSING A V.O.R.?
CONSULT
WHITTEMORE'S
FIRST
★ BIGGIN HILL 2211 (PBX) KENT ★

Precision Sheet Metal Workers and Light Engineers to the Aircraft Industry
Manufacturers of fabricated parts and assemblies in ferrous and non-ferrous metals. Tools, jigs and machined parts for the assemblies can be produced in our own workshops.
Let us quote for your requirements.
M.O.A. Approved D.G.I. No. 50037 *Fully Approved A.R.B. Ref. No. A1/2502/47*
C. W. FLETCHER & SONS LTD.
STERLING WORKS, ARUNDEL STREET, SHEFFIELD, 1
ALSO MORTIMER WORKS, MATILDA LANE, SHEFFIELD, 1
Telephones: Sheffield 28049 & 28040 ESTABLISHED 1891 Telegrams: Assayed Sheffield 1

FLIGHT BRIEFING FOR PILOTS
Volume One
By N. H. Birch and A. E. Bramson
This book covers the basic theory of flight together with fundamentals clearly explained and excellently illustrated, by Bramson, and then goes on to describe the basic flying manoeuvres giving explanations and clear instructions on the practical exercises needed for the pupil pilot. All exercises in the book are geared to the Private Pilot's Licence. The book has received official approval from the Panel of Examiners of the Guild of Air Pilots and Air Navigators.
15/- net.
PITMAN



D.G.I. Ministry of Aviation Approved. A.R.B. etc.
R.L.A. GUARANTEED LAMINATED ALUMINIUM
Spec.: D.T.D. 900/4526
Great Time Saver . . . Accuracy Assured . . . Sheets or Components.
B. ATTEWELL & SONS LIMITED
Sole Distributors
Makers of Aircraft Components for over 20 years.
Phones Iver 1102-3-4 IVER, BUCKINGHAMSHIRE. Grams "Reflection-Iver"

VACANCIES FOR LINK TRAINER INSTRUCTORS

AER LINGUS—
IRISH INTERNATIONAL AIRLINES
invites applications
for two Link Trainer Instructor vacancies at Dublin Airport.

Applicants should be Rated Instructors with wide experience in civil aviation.

Applications giving details of age, qualifications and experience should be sent to the Personnel Manager, Aer Lingus—Irish International Airlines, P.O. Box No. 180, Dublin, to reach him not later than 31st August.

CANVASSING WILL DISQUALIFY

CROSS PERFECT PRECISION AIRCRAFT SPRING WASHERS
TO B.S. SPECIFICATION 2 SP.47
CROSS MFG. CO. (1938) LTD
COMBE DOWN, BATH. Tel.: Combe Down 2366/8

NEW BALL & ROLLER BEARINGS
Over 5,000,000 in stock
In more than 5,000 types
BRITAIN'S LARGEST STOCKS
WRITE FOR STOCK LISTS
CLAUDE RYE BEARINGS
895-921, FULHAM RD., LONDON, S.W.6
Phone: RENOWN 6174 (EXT. 24) TELEX 23453

BST ARB Approved
Aeronautical Co. Ltd.
C47 · DC-3 Specialists

Stockists of British and American A.G.S. and A.N. spares for all types of British and American aircraft, from Austers to Viscounts, from Pipers to DC-4s.
24 hour A.O.G. service operated, cable or telephone your requirements.
All enquiries handled by experts with many years' aviation experience. Alternatives can often be supplied from stock if original parts are not available.
Comprehensive stock list sent by return. Purchasing agents for foreign governments and overseas airlines.

84 ALEXANDRA ROAD,
Farnborough · Hants
Telephone: Farnborough 2881/2/3.
Emergency: Guildford 66958
Cables: Bestair, Farnborough, Hants.

HAWKER SIDDELEY AVIATION

Senior Market Research Economist

We have a vacancy for a Senior Market Research Economist in our growing Market Research Group. As a part of the Sales Engineering Department, Market Research provides a service to Sales but the major proportion of work is on long-term planning. The new appointee will be directly responsible to the Chief Market Research Economist and will be concerned with the following activities:

1. The continuous review of all civil aircraft markets in relation to the latest technical thinking.
2. The analysis of airline and other statistics.
3. The detailed study of the market prospects of a variety of interesting new projects.
4. The maintenance of a comprehensive intelligence system.
5. The preparation of miscellaneous reports on a wide range of subjects.

This unusually interesting position in an expanding field combines contact with the latest Technical advances and the study of civil aviation in the broadest sense. Among the qualifications we require are:

Age 28-35
A University degree or equivalent
Several years experience in either an airline or aircraft company in positions which give a realistic appreciation of airlines' problems and future requirements
A keen interest in the whole civil aviation field

Monthly staff salary will be paid according to qualifications and experience, and problems arising in connection with a move to the Hatfield area can be discussed at interview.

If you think you have the qualities to contribute to this Company's forward planning, write us a concise letter telling us why and quoting reference 476 to:

The Personnel Manager, The de Havilland Aircraft Co. Ltd.
Hatfield, Herts.

Your reply will be treated in the strictest confidence.

THE DE HAVILLAND AIRCRAFT COMPANY LIMITED

HANDLEY PAGE LIMITED
PARK STREET, Near ST. ALBANS, HERTS.

have vacancies in their Test Department for

ELECTRICAL ENGINEERS

to carry out development testing of Aircraft Electrical Generating Systems. Senior and Junior positions are available. H.N.C. or equivalent qualification is required.

Please write giving full details to:

Staff Officer,
HANDLEY PAGE LIMITED,
Cricklewood, London, N.W.2.

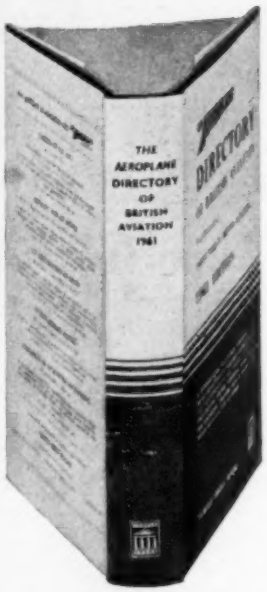
An Essential Reference Book—The 1961 Edition of

'The Aeroplane' Directory of British Aviation

Incorporating "Who's Who in British Aviation"

A complete guide to aviation in the United Kingdom and throughout the British Commonwealth the current 1961 Edition of this essential reference book records the many changes which have taken place in Service and Civil Aviation since publication of the previous edition.

All sections have been revised and brought up-to-date and this edition is of special value and interest for the clear picture it affords of the new pattern of the Aircraft Industry following the recent re-grouping of major manufacturers. Also listed are the many new appointments which followed disbandment of the Ministry of Supply and creation of the new Ministry of Aviation.



Principal Contents

R.A.F. & Commonwealth Air Force Appointments
Service Air Stations
Foreign Air Attaches
Aviation Ministries and Authorities
The British & Commonwealth Aircraft Industries
Air Transport Operators
Airline Transport Pilots Licence Holders
Civil Aerodromes in the U.K.
International Aviation Authorities
Aeronautical Societies
Flying and Gliding Clubs
The Aeronautical Press
Air Training Centres
Biographical Section with over 1,600 entries

584 pages. Size: 8¾ × 5¾ in. Linson Boards

Price 35s. net. (By post 36s. 9d.)

Temple Press Books: Bowling Green Lane, London, E.C.1

A.I.D. APPROVED
Rubbaglex
(Regd.) Patent No. 519567

Rubbaglex Sheeting is processed on 100% pure glass cloth, has very high tensile strength, is rot proof and combines flexibility and resiliency with non-stretching properties.

Impervious to Aromatic Hydro Carbons. Highly recommended for Gaskets, Washers, Jointings, Diaphragms, Sleevings, also Floating Roof Tank Seals, etc.

RUBBAGLAS LTD.
ABFORD HOUSE
15 WILTON RD.
LONDON S.W.1
VICTORIA 6501

INDEX TO ADVERTISERS

Name	Page
A	
Aer Lingus	17
Airline Air Spares, Ltd.	14
Airwork Services, Ltd.	14, 15
Automotive Products Co., Ltd.	2
Astraeus, Ltd.	15
Attewell, B. & Sons, Ltd.	16
B	
Box A001	16
British Aircraft Corporation	7, 8, 9, 10
BST Aeronautical, Ltd.	17
Burnley Aircraft, Ltd.	Inside Back Cover
C	
Canadair, Ltd.	5
Cross Manufacturing Co. (1938), Ltd.	16, 17
Cunard Eagle Airways, Ltd.	15
D	
Daimler Hire, Ltd.	2
Dundas, R. K., Ltd.	15
E	
Ekco Electronics, Ltd.	Inside Front Cover
F	
Fairey Engineering, Ltd.	4
Fletcher, C. W. & Sons, Ltd.	16
H	
Handley Page, Ltd.	17
Harleyford Publications, Ltd.	2
Hawker Siddeley Aviation, Ltd.	11, 17
Hollis Court Hotel & Country Club	16
Keegan Aviation, Ltd.	15
L	
Lockheed Precision Products, Ltd.	Back Cover
M	
Maricon, Ltd.	Inside Front Cover
Miller Aviation, Ltd.	2
Ministry of Aviation	16
N	
Napier Aero Engines, Ltd.	6
P	
Pitman, Sir Isaac & Son, Ltd.	16
R	
R.F.D. Co., Ltd.	12
Rollason Aircraft & Engines, Ltd.	15
Rotax, Ltd.	Front Cover
Rubbaglas, Ltd.	18
Rye, Claude, Bearings	17
U	
Ultra Electronics, Ltd.	3
United Aircraft International	1
W	
Westland Aircraft, Ltd.	13, 16
Whittemore, A. J. (Aeradio), Ltd.	16

Printed in England and Published Weekly by the Proprietors, TEMPLE PRESS LIMITED, BOWLING GREEN LANE, LONDON, E.C.1.
Registered at the G.P.O. as a Newspaper. Second class postage paid at New York, N.Y. Registered for transmission to Canada and Newfoundland by magazine post. Annual Subscription Rate United Kingdom 95/-, other countries 100/- (Canada and U.S.A. $15) postage included. Shorter periods pro rata. AGENTS ABROAD—EUROPE—Messageries Dawson (S.A.), Paris; Messageries, Hachette et Cie., Paris; W. H. Smith & Son, Paris and Brussels. CANADA—Wm. Dawson Subscription Service, Ltd., Toronto; Gordon & Gotch, Ltd., Toronto. U.S.A.—Eastern News Co., 306 West 11th Street, New York, 14, N.Y. AFRICA—Central News Agency, Ltd., Cape Town; Wm. Dawson & Sons (S.A.), Cape Town. ASIA—W. Thacker & Co., Ltd., P.O. 100, Bombay. AUSTRALIA and NEW ZEALAND—Gordon & Gotch (A'sia), Ltd.

BURNLEY AIRCRAFT PRODUCTS LIMITED

Suppliers of High Quality Gas Turbine Combustion components for the Jet Engine Aircraft Industry

BURNLEY AIRCRAFT PRODUCTS LTD.

FULLEDGE WORKS - BURNLEY - LANCASHIRE - ENGLAND

Telephone 7681 Burnley (5 lines) Telegrams: "AIRCRAFT" Burnley.

REPAIR DIVISION: BRITANNIA WORKS - QUEENSGATE - BURNLEY Telephone 4102.

Associated with RENFREW AIRCRAFT & ENGINEERING CO. LTD., RENFREW, ONTARIO, CANADA.

This D.H. Sea Vixen

is about to touch down on H.M.S. 'Ark Royal' after an operational exercise. Operating in all weathers in climates varying from the heat of the Indian Ocean to the cold of the Arctic Circle the aircraft and its equipment must be designed and built to give unfailing service regardless of the conditions.

Over eighty Lockheed Hydraulic components on this aircraft are proving their efficiency and reliability every day and every night of the year over the oceans of the world.

ONE OF THE
AUTOMOTIVE
PRODUCTS
GROUP

Lockheed